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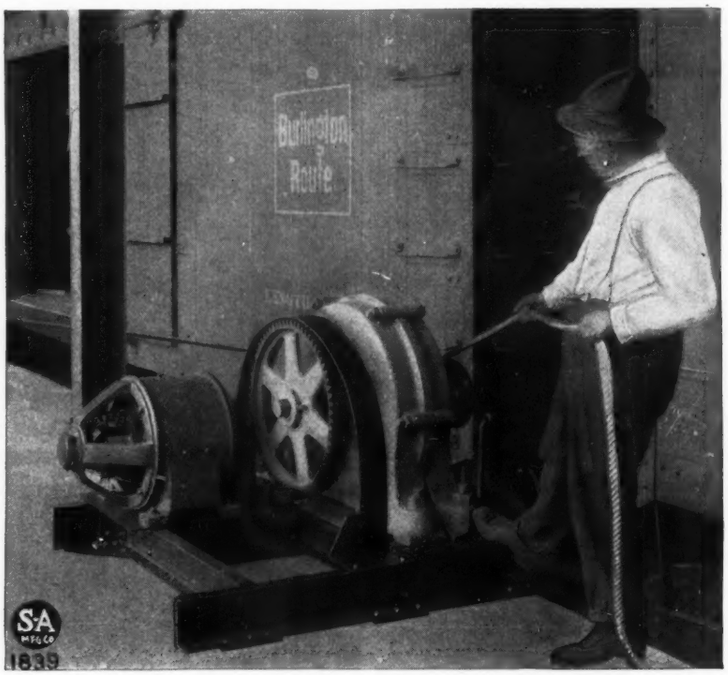

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Engineering and Mining Journal

VOLUME 103 MAY 19, 1917 NUMBER 20

Picturesque Side of Jerome

By A. J. Hoskin*

SYNOPSIS—This Arizona copper district, awakened from the somnolency of a one-mine camp to a genuine boom by the discovery of another great mine, displayed the characteristic features of overcrowded hotels, "mining sharks" and "shining marks"—with but slight variations.

Persons acquainted with the metal-mining industry of America have for years been aware that Jerome holds a prominent place among the famous producers. But a good while back, this camp became known as a one-mine camp, and consequently it has not been a favorite among prospectors, engineers and mining men. Little opportunity was afforded the public to learn anything about the underground geological or mineralogical conditions. The district did possess one most wonderful mine, but all persons not in the employ of the mining company were for a long time prohibited from visiting the workings. Professional men in private life were wholly debarred, as were also representatives of the U. S. Geological Survey. It thus happens that literature upon the technical features of Jerome is scarce. Within the last two or three years, however, the embargo referred to has been raised. Visitors are now quite welcome in the United Verde mine. Privileges for studying the mine's formations have been most courteously extended to both private and Government geologists. An official of the company prepared a paper that was presented before the Arizona meeting of the American Institute of Mining Engineers. This is a most remarkable mining property. It contains some of the biggest and richest copper orebodies in the world. It is producing fabulously right now. Its stock belongs almost solely to a single individual, ex-Senator W. A. Clark. The secrecy formerly pervading every phase of the operations was due primarily to uncertainties in the elucidation of the geology. It required years of exploitation for the company to arrive at an intelligent conception of its own holdings, and until this had been attained, the company did not wish to invite any complications that might arise from conflicting or neighboring ownerships.

About the time the knowledge of the United Verde's natural features were released to the public, the market for its chief metal content began to soar. Naturally, Jerome was a district to which attention was directed in the scramble for new copper mines. The activities of copper shares upon the exchanges during the last two years do not require recital here. Special attention was directed toward Jerome last year by the success in the Little Daisy claim. Here was struck a great orebody similar to those in the adjacent United Verde property. Stock in the United Verde Extension Copper Co. (owning the Little Daisy) promptly advanced from a few cents to more than $40 per share. This was the cue for a grand rush to Jerome. The last few months at this little city have been most active.

IN THE JEROME DISTRICT, LOOKING EAST TOWARD CLARKDALE

This view was taken near the United Verde mine and shows the north end of the town of Jerome, the United Verde extension operation, and in the distance the stack of the United Verde smeltery at Clarkdale

The town of Jerome is reached by a narrow-gage, crooked railroad about 25 miles in length, belonging to the United Verde Copper Co. It branches from the Sante Fé system at Jerome Junction, a station 39 miles south of Ashfork. Jerome is in Yavapai County and a little northwest from the center of Arizona. One of the picturesque phases of Jerome is this railroad, service on which is limited to one train each way per day. The

*Mining engineer, Leadville, Colo.

train equipment consists of a string of freight cars with a single dinky combination daycoach-baggage-car whose comforts require no description to experienced travelers.

Upon arrival at Jerome a visitor finds he is not really there. He succeeds, after some effort, in extricating his baggage and himself and in getting off the car, only to learn that the hotels and business houses are away down the mountainside, some distance to the south. The trip thence is made in one of the numerous stages that meet all trains. The arrival of the loaded stages in front of the hotels and the post office is an event awaited each evening by throngs that scan the incoming passengers. The narrow street and the sidewalks are actually jammed for a few minutes. If it be the traveler's first visit, he may, for a few moments, experience a sense of relief at having finally negotiated the tedious two-hour-or-more circuitous railroad trip and the exciting wagon ride, but he may soon find that it is sometimes a more difficult thing to exist in, than to reach, Jerome.

Hotel accommodations were not prepared in this town with any anticipation of the demands that have been made upon them for the last year. There are two hostelries close together, opposite the post office. Each is two stories in height and does not occupy much ground. When a newcomer succeeds in "V-wedging" his way through the crowds on the walk and in the lobby up to the desk of one of these hotels and is about to affix his signature to the register, he is apt to be peeved when he hears the proprietor or clerk nonchalantly remark, "No use registering." A brief discussion conveys to the newcomer the information that he is welcome to sit in a lobby chair all night—if he can get one first.

Hotels Inadequate for Boom Crowds

Perhaps a stranger en route to this camp has heard that hotel space is at a premium and he has demonstrated his business foresight by secretly wiring ahead somewhat as follows: "Connor Hotel, Jerome, Ariz. Please reserve me one room with bath for tonight." When this astute gentleman subsequently approaches the desk with his full consciousness that he is much brighter than the men who have stood in line ahead of him, he, too, is destined to a sudden attack of downheartedness. For he is soon told that no attention is there paid to telegrams such as his, because every room in the house is occupied and has been engaged in advance for at least another month. The disappointed one concludes he must have wired to the wrong house. So he gathers up his hand-baggage and trudges to the other hotel, where pretty much the same tragedy is enacted for his benefit. It is now a really serious matter, for night has set in, he is a stranger, the few streets are dark and steep and, worst of all, he is in competition for accommodations with others, many of whom have been here before.

I was one of a motley crowd that arrived one evening last December. Just after I had received full initiation into the ceremonies just described and was about to resign myself to a sleepless night, I felt a friendly hand on my shoulder and, looking around, recognized an old acquaintance from Denver. It took only a few moments to clarify the troubles; two in a bed was a proposition soon accepted. This friend had been fortunate in inheriting a room in the hotel from another friend who engaged it by the month, but who had departed some days before, leaving him in possession.

I thought to celebrate my good luck and to extend a courtesy to my friend in this extremity. A door standing open at one side of the hotel lobby revealed a bar. But the delusion was promptly made manifest, this being now only a quick-lunch counter. We adjourned to a drug-store half a block away and indulged in malted milk. Arizona is really "bone dry." Accomplishment of total prohibition in a state such as this is really most significant. If this portion of the arid Southwest, the population of which comprises miners, cattlemen, Mexicans and Indians, can see the good in legally enforced temperance to the extent of giving it an overwhelming indorsement at two state-wide elections and can further back up its judgment by such effective methods as prevail in Arizona, why cannot any other state do the same thing? Public sentiment is so intensely for prohibition there that no sort of public office can be secured until the applicant pledges himself to follow and to enforce the law.

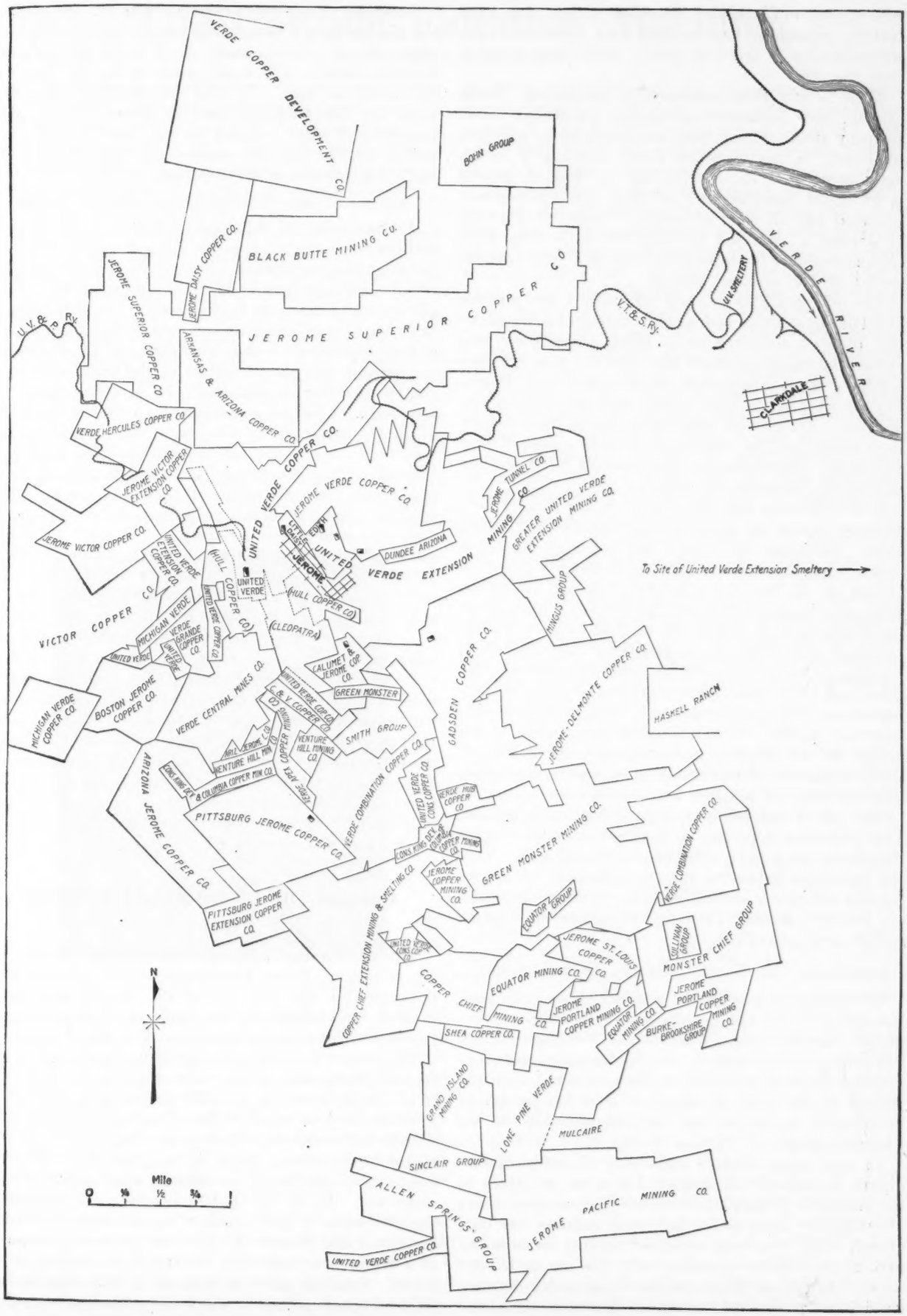
Satisfying one's natural desire for food is, at Jerome, one of the routine "indoor sports." This rush was not expected by the hotel and restaurant keepers. New eating houses have sprung up to meet the needs. In general, these places are relatively clean and the "grub" is palatable, but owing to the congestion at every mealtime, the service always brings forth most amusing repartee between waiters and patrons. The "H. C. of L." has not avoided Jerome; prices on menus are as high as in New York.

Descent to Clarkdale Is Easy but Thrilling

The new City of Clarkdale is one of the objects viewed by the visitor the morning following his arrival at Jerome. It is, in an air-line, about four miles almost due east of Jerome, in the Verde River valley, at an altitude approximately 2000 ft. lower. This town has been built by the United Verde company to house and to fulfill the needs of the population employed in the big new smeltery and on the railroad that connects it with the mine. This railroad has its upper terminal in a long tunnel that has been driven to reach the 1000-ft. level in the United Verde mine. Here it obtains its train-load of copper ore and the locomotives "back-pedal" it down a most crooked route with a drop of 1000 ft. to the smelting works.

Along systematically laid-out streets in Clarkdale, the company has erected hundreds of simple but substantial residences for its employees, as well as all sorts of mercantile establishments. Trips between Jerome and Clarkdale are made by auto over a steep but good road. It is thrilling to ride down in 13 min. I secretly cursed the chauffeur all of the six steep miles. Thirteen minutes is too long to hold one's breath and be comfortable. But this joy-riding is the fashion, and many trips are made back and forth daily.

Clarkdale is the terminal of another short railroad—the Verde Valley Ry. This road was built from Cedar Glade on the Sante Fé line, 38 miles to the northwest. Mixed trains leave Clarkdale daily at 10:30 a.m. and return at 5:50 p.m., the trip in each direction requiring about two hours. This road is of standard gage and is along the Verde valley for a considerable distance. Jerome could be approached via Clarkdale, but owing to the prevailing train schedules, there is no saving of time, money or energy by taking that route. There is no



MAP OF MINING CLAIMS IN THE VERDE MINING DISTRICT, JEROME, ARIZONA

mining close to Clarkdale. Therefore mining men, prospectors, promoters, brokers and stock speculators pay little attention to this busy place. Each town is visible from the other

There is very little vegetation in the district. Probably the now dismantled smeltery of the United Verde company at the mining town had much to do with this condition. A few pines are found occasionally in the outlying parts of the district, but the flora in general is of desert varieties such as manzanita, greasewood, ironwood and all sorts of cactus. Water for the City of Jerome is conveyed by pipe line laid along most crooked contours for several miles from a stream to the south. It is of excellent quality.

The mining claims are laid off without any pretense at following outcrops and with no notion of the application of apex and extralateral rights. Surveyors have plotted the claims like town lots, with the view of covering the greatest acreage with the least number of claims. Few, if any, of the later claims have any mineral indications. The ground is located to provide bases for new stock companies; the search for ore is of secondary consideration. This conforms with practices in all districts that do not possess fissure orebodies.

It is surprising how few claims in the district have advanced beyond the status of mere locations with 10-ft. holes. Patenting the ground has not been deemed a serious thing. Location rights are thoroughly respected as long as the requisite amounts of annual assessment work are performed. Then, too, the rush for mining groups has been such that neither the original locators nor the promoters have held on to properties long enough to put through, or even to begin, procedures for obtaining fee titles from Uncle Sam. Many companies of large capitalization and with stocks pretty well outstanding hold only possessory rights. If the stipulated development of the groups be not properly performed each calender year, these companies will find themselves automatically minus their holdings—if jumpers should intervene.

The proved mineral area in this district is limited. This statement must not be confused with any notion that the mineralization is limited to a small area. Very few properties have thus far produced ore. A few of the new companies are sinking deep shafts, while others are driving tunnels. There are but a few outcrops or surface exposures of ore.

Limestone and Basalt Capping Over District

The geology of this district as a whole has never been thoroughly worked out by competent authorities. As explained, the formations in the United Verde ground are now pretty well understood. So it is the practice of every promoter to dwell at length, in his prospectus, upon the geology of this mine, as though it were the geology of the district in general and applied especially to his particular property. Perhaps it does.

To some extent there is uniformity of geological conditions throughout the district, but at no one place in the district is it possible to observe the complete series of rocks. In most places the basalt capping has been eroded, while over large stretches nothing remains but part of the schists—generally only the quartz-feldspar schist. In places there are small amounts of white quartzite, a metamorphic form of the white sandstone. Some prospectors have mistaken it for vein quartz.

Inasmuch as the only orebodies thus far disclosed in the district have a close relationship to the dioritic rock (generally as a replacement of it or of the adjacent siliceous schist), this would seem to be the habit of mineralization here. To find ore, search is therefore made for this particular rock in place. The mining companies of which so much has been heard on the stock boards for the last few months are engaged either in costly exploitation or in preparing for it.

Mining Sharks Watching for Shining Marks

A description of this district would be incomplete without some reference to the mining sharks watching for their shining marks. They are in evidence here, as they have always been in booming mining camps. They afford much amusement to most people who visit Jerome. It is not believed that they are more than breaking even at their profession. Just to what extent actual dishonesty has entered into the promotion of the many new companies can never be estimated. It is certain there has been some. I had an opportunity to learn the sentiment of the visiting public in this matter while riding up the road from town to the railroad station. The stage was crowded with men—prospective investors most of them were when they arrived—and they were airing their opinions about the various properties whose stock quotations they were eagerly watching, day by day. Suddenly one man with a sense of humor remarked aloud: "Look out, there! You can see a wildcat on every rock." All joined in the laugh that followed, but every man denied that there was any possible chance for him to be bitten or scratched by these animals; he had investigated his company.

Jerome is a wonderful mining camp. It has been a splendid producer, and it will continue to maintain and will probably exceed its records for many years to come. It is my hope that many more mines like the "U.V." and the Little Daisy will result from the sums that are being expended. If you wish to get really excited and bodily weary, go to Jerome, tramp over the hills, see all the new activities and experience some of the features of a mining boom. You will never forget Jerome if you do.

Patents on Uranium Metallurgy for Public Use

Two patents to Charles L. Parsons, chief chemist of the Bureau of Mines, Department of the Interior, and dedicated for the free use of the people, have been granted for a process for the purifying of uranium compounds and for a process for preparing oxides of uranium.

The process for the preparing of uranium oxide is of especial importance at this time owing to the fact that it is now definitely known that the Germans are using uranium steel in some of their large cannon, and this process will enable pure black oxide of uranium to be obtained for the use of producing ferro-uranium. Experiments in the production of uranium steel itself are now under way. By the use of the processes above mentioned the production of pure oxide of uranium is very much facilitated and cheapened. Also the product is obtained in a much purer form than has ever been acquired heretofore. Uranium oxide so obtained is also valuable for coloring glass, giving to glass the golden yellow color seen in some of the new automobile headlights.

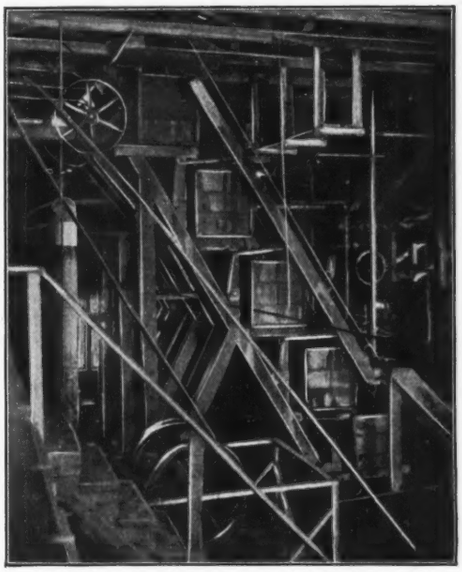
The Cascade Flotation Machine

By Clifford R. Wilfley*

SYNOPSIS—The development of a flotation system wherein froth forming is accomplished without the expenditure of power is described. The basis is in allowing the oiled pulp to plunge from one compartment to another, thus providing the stirring necessary for froth production.

The Cascade flotation machine is cheaply built and operated, embodies something of a novelty and has proved so useful that a description is of interest. So far as known the apparatus has not been patented. It was developed by me at the Mineral Farm mill, Ouray, Colo., in 1916. The idea was suggested by A. R. Wilfley, who built and successfully operated a similar machine at about the same time, at Silverton, Colo. The Mineral Farm plant closed down in November on account of lack of water, before the machine was fully developed, but it will soon be in operation again.

The device was the outcome of necessity. The mine showed too small an amount of ore to justify an expensive plant, and the old stamp mill with tables was too inefficient for the ore, so an inexpensive flotation unit was needed. Although conditions were not favorable to flotation on account of the simple flow sheet, the results were good and two other plants have installed these machines, and still two others are being designed, one for a 125-ton mill, the other for a 7-ton "prospector's mill." The original object seems to have been attained, of devising a cheap, readily made apparatus for the small mill, while larger plants are beginning to use it as standard.



THE CASCADE FLOTATION MACHINE

The feature is the utilization of an idea that has doubtless occurred to many flotation operators, who have "wanted to see it tried." Perhaps it is in use, but I have not heard of any plant that has developed the conception and adopted it for the sole flotation device, except the ones mentioned. The idea is simply the formation of froth by causing the oiled pulp to plunge into a pool of pulp by gravity, the plunge forming a froth which floats and is skimmed off, while the pulp is drawn off separately and continuously.

The application is shown in the sketch, which represents diagrammatically the arrangement of pools and gravity flow. The pools are individual boxes, or cells, with pulp kept at a constant level, each discharging pulp by gravity to a succeeding cell. A series of rectangular boxes is arranged in a tier, or tiers, step fashion, on an inclined supporting frame, in such manner that spigots at the lower front edge of each cell discharge over an inclined feed apron into the pool of the following cell at the upper back edge. This gives a wide, thin sheet of pulp plunging at high velocity across the full length of the cell into the pool. This "cascade" effect suggested the name adopted.

The froth floats on the quiet surface of the pool in front of the cascade, covering the surface to the front lip of the cell, which is lower than the three other sides. Here it is skimmed mechanically over the baffle-like froth apron into collecting launders.

In order to maintain a constant level automatically and take care of uneven pulp flow, a level open slot is provided at the front lip under the froth baffle, and a small amount of pulp is kept running over the lip through the slot and down the front side of the cell, joining the flow from the spigots below. In operation, the spigots are regulated by hand to keep a thin sheet of pulp overflowing, and this flow takes care of surges or decreases in the feed.

Machine Built in Tiers

It is usually inconvenient to build the machine with all cells in one tier, on account of the height required, so most machines so far have been built in two tiers with a pump or similar elevator lifting the pulp from the bottom of the first tier to the top of the second; in one case three tiers are being used, with four cells in each tier. An interesting feature being applied in multiple-tier arrangements is the splitting of the pulp discharging from the intermediate pump, a portion of the pulp being returned to the head of the first tier, the remainder going on through the second. This is a "hit-or-miss" idea which reduces capacity in terms of original feed, but it has been used effectively when the machine is running under capacity.

No single-tier machine having been used as the sole flotation apparatus, it has not been shown how effective this would be in comparison with the multiple-tier arrangement of an equal number of cells. Where the oiling of the pulp has not been thorough, the pumps between tiers seem to assist frothing, but with thorough oiling in a ball mill this is much less marked.

Capacity has not been worked out, but the machine seems able to handle a large volume, probably on account of the rapid flow. No doubt a series of tests will determine a proper range of pulp dilution and the like, but so far it seems that dilution has little effect on efficiency, except, perhaps, in volume of froth. Capacity is, of course, proportional to the length of cell across which the feed apron discharges; 30-in. cells have been handling up

*Mining engineer, Ouray, Colo.

to 50 tons per day and have evidently been under capacity, while a 5-ft. cell has handled up to 400 tons per day of tailings from an agitator type of flotation machine. A two-tier machine with 30-in. cells, occupying a floor space of 6 x 14 ft. and a height over all of 18 ft., is generally good for 50 to 100 tons per day.

While almost any old box will give a good froth, the effectiveness of the machine depends a good deal on proper proportioning of the cell, depth of pool and the height of free fall from the lip of the feed apron. For most ores a cell with 24 in., front to back, with a depth of pool of 24 in. and a free fall of 8 in. is sufficient. These dimensions may be changed and possibly reduced, by experiment.

Modifications of the Machine

Many ingenious modifications suggest themselves, and it is hoped they will soon be worked out, further improving the apparatus. Chief of these is elimination of the spigots, delivering all the pulp over the lip of the cell under the froth apron, thus greatly reducing the height required; but this must be carefully investigated, as there is danger of clogging the whole cell and also of including too much gangue in the froth, mechanically carried over.

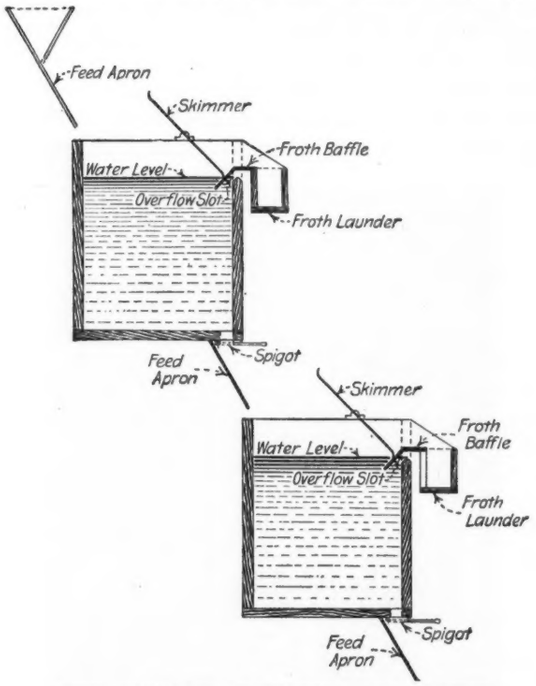
The machine has not been operated long enough under proper conditions to allow of testing its efficiency in all respects. At the Mineral Farm, the ore was lead-silver with considerable iron, in a quartz-lime-barite gangue, concentrating about five into one. The flow sheet was very simple, the ore being stamped through 24-mesh, "roughed" on a Wilfley, and the tailings sent to flotation and subsequently over a pilot table. The oiling of the pulp was a mere paddling in a box at the head of the flotation machine, with centrifugal pumps assisting. All concentrates were mixed to give better draining and drying, and no cleaning to make higher lead was attempted; a good deal of barite in able middlings contributed to the insoluble content of the mixed concentrate. Under these conditions the mill saved 80 to 85% of the lead and silver; the lead saving ran several per cent., ahead of the silver and sometimes reached 90%. The concentrate assayed 30 to 40% lead and 30 to 35 oz. silver, and 20 to 40% insoluble; cleaning of the concentrate on a table will probably be practiced this year and will undoubtedly improve the grade. The ore averaged about 6½% lead and 7 oz. silver. At the mill of the Gold Crown Mining and Reduction Co., Ouray, a cascade machine has just been started, on a gold-copper ore heavy in iron. The oiling is done in a ball mill, and a very good, though somewhat dirty, froth is being made in a 3-tier, 12-cell machine. So far the feed has been quite low-grade and the oil mixture has not been worked out, but at that the machine shows a saving of as high as 70% of the gold and copper, figured on the assays of the flotation feed and tailings. A high ratio of concentration is indicated by the high copper content of the concentrates.

The machine will probably prove to be as efficient as most of the standard machines—perhaps better in some cases—with a somewhat dirtier froth. The idea of "cleaner cells" can probably be used with the cascade machine as well as with the others, though it has not yet been tried.

The froth is fairly voluminous; it is rather firm and strong, probably lying between the agitator and pneumatic types in this respect. Its volume and character are affected by kind of oils, fineness of ore and the like, as with other frothing apparatus, but it does not build up to great heights nor does it overflow readily when skimming is stopped. The number of cells needed is about the same as for the agitator type of machine—say 8 to 16. Twelve is the largest number used so far and probably all that would be economically efficient in most cases.

The chief advantages are cheapness and simplicity, both in first cost and in operation, as well as large capacity without multiplying machines. The construction and installation can be done by any good carpenter right at the plant, with simple plans giving dimensions, as the material is mostly lumber. The spigots can be of any kind, preferably regular classified discharge gates, though common iron 50c. molasses gates are being used. The skimmers can be reciprocating mechanisms or common revolving paddles.

The cheapness of the operation is perhaps the strongest point, this being due to the small amount of power used. The power, aside from skimming, which is small, is that necessary to elevate the pulp 15 to 18 ft. when pumps are



THE CASCADE FLOTATION APPARATUS

necessary—once or twice, as the case may be, depending on whether or not it is necessary to elevate the pulp to he feed of the machine. A simple calculation will show that this power is much less than that needed for agi-ators or pressure blowers. The attendance is simple, requiring only part of the time of one man.

Compactness comes from two features: First, multiple-tier machines are built with one long box in each step for all cells in that step, the individual cells being formed by partitions; second, larger capacity is obtained by simply lengthening the cells without increasing other dimensions. Theoretically, the capacity can be made infinite in one machine though practically there might be limitations.

Finally, and perhaps above all, the apparatus is a valuable thing for the "little fellow," as was demonstrated in the first installation. The man with five stamps or a Huntington can build a cascade in his tailrace and run all tailings through without any mill changes, or even any

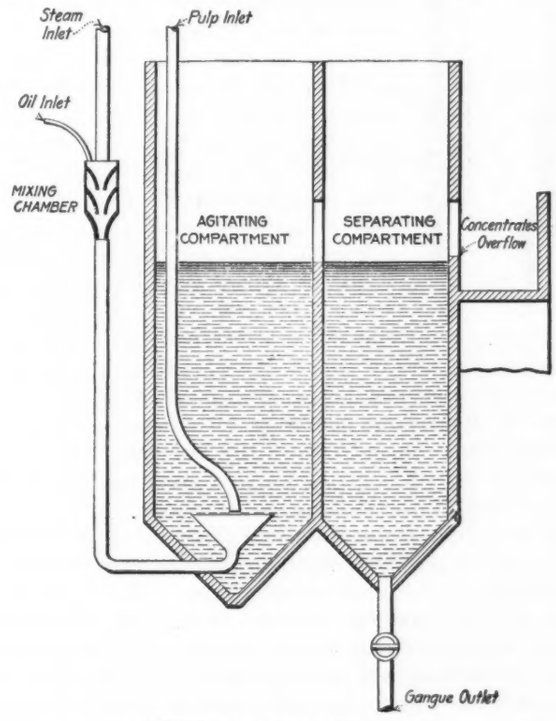
pumps where the fall is available, thus picking up a respectable amount of concentrates from what was formerly slime loss. He would have the froth-handling trouble common to all, but would probably get along easier in this respect than the man with the large mill. The machine is capable of all gradations in its application, from this primitive tailrace cascade to complete flotation apparatus.

Further development and experiment will be accomplished this year in several plants, and it is hoped that various details of construction will be worked out with improvement to the machine, while metallurgical facts and figures will be compiled. While nothing startling may have been developed, it is believed the results obtained already, justify a claim to some originality and a useful contribution to the art.

Gröndal Flotation Device

A flotation machine designed to improve the mixing, or distribution, of oil over mineral particles has been designed by Gustaf Gröndal, of Sweden, to whom U. S. Patent No. 1,202,512 has been granted. The patent is under date of Oct. 24, 1916, and has been assigned to Beer, Sondheimer & Co., of Frankfort, Germany.

The invention consists in distributing oil under pressure into steam or air and afterward mixing this oil-laden gas, still under pressure, with a larger quantity of gas and then injecting it into the ore pulp. A suitable apparatus for carrying out this idea is shown in the accompanying illustration. Through a small pipe the necessary quantity of oil is fed into a Körting steam-jet apparatus, beneath or near the mouth of the steam conduit. The steam under pressure, during its passage through the steam-jet apparatus, is mixed with oil and delivered through a pipe with a funnel-shaped outlet into a reservoir, this reservoir being continually fed with ore pulp through a pipe that delivers it at the mouth of the funnel-shaped opening through which the oil-carrying steam or air is delivered to the reservoir. By means of the pressure of this oil-carrying air, a thorough mixing takes place in the chamber, oiling the particles of mineral. The pulp overflows into an adjoining compartment whence the concentrates overflow into a side launder and the gangue, or valueless rock, falls to the bottom of the compartment, where it is drawn off. The gist of the invention is the mixing of oil with the air or steam and subsequently injecting it into the pulp under pressure.



GRÖNDAL FLOTATION CELL

Oil-Shale Lands Subject to Mineral Entry

During the last year large areas of land in Colorado, Utah and Wyoming have been classified by the Department of the Interior as mineral land valuable for oil shale. The lands so classified, except two small areas, one each in Colorado and Utah, which have been set aside as naval oil-shale reserves, are open to mineral entry under the mining laws of the United States and to nonmineral entry in accordance with the provisions of the act of July 17, 1914, the oil-shale deposits when entries are made under this act being reserved for separate acquisition under the mineral-land laws.

In Colorado the naval oil-shale reserve comprises lands having a total acreage of 45,440, whereas the total area classified as oil-shale land in this state includes about 896,000 acres. In Utah the naval oil-shale reserve includes lands having a total area of 86,584 acres, whereas the area classified as oil-shale land includes approximately 2,636,000 acres. In Wyoming approximately 460,000 acres has been classified as oil-shale land, and none of it has been included in a naval oil-shale reserve. The area underlain by oil shale in Colorado and Wyoming and a small area near Watson, Utah, are shown on maps contained in United States Geological Survey *Bulletin 641-F*, a copy of which may be obtained free on application to the Director, United States Geological Survey, Washington, D. C. The oil-shale area in Utah will be shown on maps to be included in a report on the last season's field work in that state.

Luis Cabrera on Mexico's Neutrality

Secretary of the Interior Lane made public under date of May 1 the following letter received from Luis Cabrera, Minister of the Treasury of Mexico:

"All Mexicans who know and appreciate the United States are now striving to keep Mexico absolutely neutral in the present world-conflict, which unfortunately has extended to America.

"I have been reading some of the articles sent to me from the United States, but my opinion about the present situation is rather formed from letters of my friends which I frequently receive.

"Although I believe that the war between the United States and Germany will actually take place in Europe and not in America, the United States can be sure that the present government of Mexico will do everything in its power to make the United States feel absolutely confident that there will be no reason at all to fear from our side.

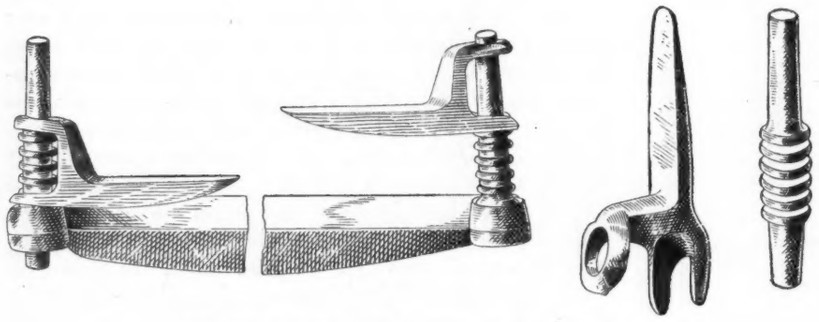
"Mexico has gone through a civil war, and there is nothing the people desire more than to remain in peace and without being engaged in an international war."

A New Zinc-Condenser Support

By Irving A. Palmer*

An adjustable grasshopper has been patented (U. S. Patent No. 1,218,055) by W. E. Clayton, of Altoona, Kan. As zinc metallurgists know, the grasshopper is the small bracket casing that supports the front end of the condenser used in the ordinary zinc-distillation process. The standard grasshopper now in use is cast in one piece in the form of a bracket so constructed that it can be inserted into a vertical hole at one end of the iron plate immediately in front of the retorts. The bracket can be swung freely into a position beneath the condenser. Owing to its construction, however, the height at which it supports the condenser can vary but little.

The new adjustable grasshopper consists of two castings, one of which is an upright corrugated standard for inserting into the furnace plate and the other a transverse arm forked at one end and supplied with a hole and slot by which it can be adjusted to the upright part at any one of six different heights. The details of the apparatus are clearly shown in the illustration which shows the two parts separate and independent of each other for the purpose of a better indication of their construction. On the left are shown two of the grasshoppers in position at opposite ends of the furnace plate, one bracket adjusted at its minimum height and the other at its maximum.



DETAILS OF ZINC-CONDENSER SUPPORT

The use of the new grasshopper enables the furnaceman to maintain all the condensers at the proper level, no matter what the condition of the furnace may be. As experienced zinc men know, after a retort furnace has been in operation for some time, the warping and destruction of the brickwork makes it impossible to keep the mouths of all the retorts in a given row at the same level. The result is that if the ordinary support is used, some of the condensers will be too high in front and others will be too low. In the former case part of the condensed metal will run back into the retorts or down the sides of the furnace. In the latter case the metal will run too far forward and will be liable to break through the coal stuffing or to partly solidify. In either case losses of metal are almost sure to occur. Besides, the work of the metal-drawer is made more difficult. Sometimes the mouths of the retorts are so much out of alignment that it is impossible to use the ordinary supports at all, and pieces of brick or clay are substituted.

The adjustable grasshopper weighs about 3¾ lb. complete, or somewhat less than twice the weight of the old-style bracket. The cost is therefore higher than the latter, but is small when compared with the possible metal savings effected by its use.

The new grasshopper is being used at the Bartlesville plant of the American Metal Co. and at the Altoona plant of the United States Smelting Co. At both smelteries it is giving good satisfaction. It is being placed on the market by Moniot & Clayton, of Altoona, Kansas.

*Metallurgist, Altoona, Kan.

Iron and Lead in China

Chang Chien, ex-minister of the Ministry of Commerce and Agriculture, China, is reported to be planning the establishment of works in the Tayeh district of Hupeh for the treatment of rich iron deposits recently discovered there, says a bulletin of the Far Eastern Bureau.

The ex-minister is said to be organizing a company to be known as the Chi-Hwa Co., with such well-known members as Messrs. Sun Yat-sen, Sun Pao-chi, Tang Shao-yi, Chen Chin-tao and Ku Chun-hsui. It is to be capitalized at $5,000,000. The ore in this new location is believed to be even richer than that of the mines operated by the Hanyehping company.

The new model iron works, built under the supervision of China's Ministry of Agriculture and Commerce, is almost completed and will be soon put into operation. The principal workshops of the central plant are at Luan-hsien in Chihli, and will be fed from all the mines in the neighborhood. The initial cost of this plant is placed at $2,000,000, and it is estimated that its daily output will be about 300 tons of manufactured iron. In addition to the central works at Luan-hsien, a branch works will shortly be established at Pukow in Kiangsu, to cost about $3,000,000. These works will be run on a bigger scale and will turn out over 500 tons of iron a day. Besides the enormous amount of iron used for her own needs, China is called upon to supply large quantities for other countries, and meeting these demands, which the European War has so greatly increased, is giving China a great impetus in the exploitation of her rich natural resources.

Reports from China state that there are 10 flourishing lead mines being successfully operated by private Chinese companies in the province of Hunan. They are situated at the following places: Kianghua, Pinghsien, Liangsiang, Kueiyang, Liling, Lingwu, Liuyang, Hengyang, Suikouling and Chowkiagang. A systematic investigation of China's mineral resources has been ordered by President Li Yuan-hung, and Mr. Ku Chung-hsiu, minister of agriculture, has apportioned Chinese experts to the various mining localities to compile authentic data.

Solubility of Lime has been the subject of experiments by A. F. Crosse, as noted in the "Journal" of the Chemical Metallurgical and Mining Society of South Africa. The textbooks give 1.26 grams per liter at 20° C. as the solubility, but Crosse agitated lime in water for 30 minutes (air agitation) and after settling for 16 hours the clear solution contained 1.47 grams per liter. The second day it contained 1.34 grams and the third day the solution had become normal. The theoretical solubility of lime at 0° C. is 1.3 grams per liter, but Crosse succeeded, by agitating with ice to get a supersaturation up to nearly 2 grams per liter. Lime was recovered as CaO, not the hydrate.

Suggestions for Selecting and Testing Drill Steel*

Mining with rock drills has progressed to a point where the actual efficiency of the drilling operation depends more on the drill steel than ever before. In order that the steel can meet these conditions, one must be able to obtain a uniform quality of steel and be able to subject the steel to the proper treatment. There must be means of doing this from day to day. As a suggestion for meeting these conditions the facts in this article are presented.

Although the chemical qualities of steel have a great influence, the analyses of drill steel are practically standardized. A chemical laboratory would be a good asset, but it is not essential for this work. When the proper heat-treatment has been given to the steel—assuming the steel to have the chemical properties as specified for standard drill steel—and the treated steel is either too soft or gives exceptional service, a sample of it could be sent to a commercial laboratory for chemical analysis.

Drill steels are made by both the openhearth and crucible methods. The crucible-made are lower in phosphorus and sulphur as a rule, while the openhearth is lower in silicon. For each grade in either make, the carbon content will vary according to the size of the steel. In general the average analysis of a drill steel would show:

	%		%
Manganese	0.25 to 0.40.	Some makes as low as	0.15
Phosphorus	0.01 to 0.025.	Some makes as high as	0.04
Sulphur	0.015 to 0.025.	Some makes as high as	0.04
Silicon	0.10 to 0.20.	Some makes lower	
Hardness (as received)	40 to 50 scleroscope or 225 to 300 Brinell		

The carbon content will vary as follows, as to shape, size and make:

	% Carbon
American-made octagon	0.80 to 1.00
American-made cruciform	0.80 to 0.95
American-made hexagon and round hollow	0.70 to 0.80
American-made solid and hollow spiral	0.70 to 0.85
F.J.A.B. No. 7	0.65 to 0.85
F.J.A.B. No. 10	0.90 to 1.05

It is advisable in selecting a drill steel that either a steel company or a drill manufacturer be consulted, as their experience fits them to suggest the best steel for the conditions. Request the steel company to give the critical range of the steel and the proper forging, annealing and hardening temperatures.

Each bar of drill steel as received should have a 3- or 4-in. test piece cut off and the piece and bar numbered. In this way a record can be kept of when the bar was received, from whom and the service given. Determine the Brinell hardness on the cut end of the test piece and then subject the piece to a simple forging operation, heating to the recommended forging temperature. Anneal the piece as recommended and then harden, using the recommended temperature and quenching medium. If the steels as used are drawn or tempered, the test piece should be heated to the same drawing temperature. Determine the Brinell hardness on this properly treated test piece, then break it and examine the fracture, noting the grain. If the fracture shows a seam or pipe, the bar should be rejected.

Each drill steel made should bear the same number as the bar from which it is made, and a record should be kept of the service of the drill steel. In this way a record will be had of the Brinell hardness of the steel as received, the complete heat-treatment, the hardness of the heat-treated steel and the service of the steel in the mine. After a hundred or so tests have been made, some of the high, medium and low Brinell test bars and those giving the best service can be analyzed. In this way a standard specification can be determined for the drill steel best suited to meet the conditions of the mine, giving the desired carbon range (10 points) and the Brinell hardness range.

The essential equipment consists of the following: Brinell testing machine; furnace for heating the steel, equipped with pyrometer; quenching tank; tempering or drawing bath; means of forging. Except the testing machine, this equipment can be found in the blacksmith shop.

Hints as to Apparatus

Gas or oil-fired furnaces of the muffle or semi-muffle type give the best results and are easily manipulated so that a constant temperature can be maintained. Furnaces should be adapted to meet the conditions.

Pyrometers are essential. Base-metal couples should be used either with galvanometer or potentiometer. Use equipments that automatically take care of the cold junction. Both the Wilson-Maeulen base-metal equipment and the Leeds & Northrup potentiometer equipment have proved serviceable. Adapt the pyrometer equipment to the conditions.

Place the base-metal couple in an X or XX iron pipe plugged or welded shut at one end, then place this in the chamber of the furnace as near to the drill steel as convenient. The indicating instrument should be somewhat away from the furnace, so placed as to be free from vibration and excessive changes in temperature.

The pyrometers should be checked weekly at least. One base-metal couple can be kept as a standard and compared with the one in service. When the regular one shows too great a variable error, use the standard as regular and purchase a new couple to use as standard. The indicating instrument should be sent away periodically to be tested and regulated. Complete information and instructions should be obtained from the manufacturers at the time of purchase.

It is not essential to have an equipment for determining the critical range. Obtain this range from the steel maker. The hardening heat is higher than the critical range and depends on the shape and size.

Hints as to Treatment

The following table will show the approximate critical ranges and hardening temperatures of steel relative to the carbon content:

Carbon Content, %	Critical Range, F.	Hardening Temperature, F
0.60	1,340 to 1,380°	1,400 to 1,460°
0.70	1,340 to 1,375°	1,400 to 1,450°
0.80	1,340 to 1,365°	1,390 to 1,450°
0.90	1,340 to 1,360°	1,375 to 1,450°
1.00	1,340 to 1,360°	1,375 to 1,450°
1.10	1,340 to 1,360°	1,375 to 1,430°

The forging temperature for drill steels should be from 1550 to 1600° F. Do not continue the forging operation after the steel fades from a red color, as forging a steel cold or below its critical range distorts the structure and tends to produce brittleness. Reheat the steel, if necessary, to finish the forging operation.

In annealing, heat the steel just above the critical range and cool slowly. In hardening, if the steel is rapidly heated, it should be held just long enough to heat thor-

*By Frank H. Kaiser, metallurgist, Sullivan Machinery Co., Claremont, N. H., in "Engineering News," Mar. 22, 1917.

oughly. Uneven heating results in a soft center. On the other hand, the steel should neither be held too long at the hardening temperature nor soaked, as such treatment opens grain or enlarges crystals, tending to brittleness.

The quenching bath should be large and deep. Clean water is a suitable quenching medium, but for uniform results it should be kept at 60 to 80° F. After the steel is quenched, it is in its hardest condition, with a tendency to be brittle; accordingly, it will not well resist shock. To obviate this, it is well to draw the temper, thus sacrificing a small amount of the original hardness for a like gain in toughness. The temperature to which the steel should be drawn will depend on the condition of the rock. This must be determined by experimenting. The drawing temperature will vary from 350 to 600° F. Use a heavy or 600-deg. fire-test oil for the drawing medium, reading the temperature with a thermometer. The "Tycos" armored thermometers, of the Taylor Instrument Co., Rochester, N. Y., are suitable.

In treating the shank end of the steel, after forging and annealing, heat to the proper hardening temperature and quench in oil. The oil tank should be large and the oil kept at a uniform temperature by circulation through a coil surrounded by water or by circulating the water through a coil around the inside of the oil tank. No. 2 soluble quenching oil, made by E. F. Houghton & Co., Philadelphia, Penn., is suitable. When the steel has reached the temperature indicated by the pyrometer, the color of the heated steel will be the same as that of the iron pipe in which the base-metal couple is in direct contact with plugged end inserted in the furnace.

In conclusion I desire to urge coöperation with the steelmaker in all drill-steel troubles, as I believe he is as anxious to give satisfaction as the user is to obtain it.

Metallurgical Fellowships at Utah University

WASHINGTON CORRESPONDENCE

In the department of metallurgical research of the State School of Mines, University of Utah, there have been esablished a number of research fellowships in metallurgy, having an annual value of $720. These fellowships are open to college graduates who have had a good training in chemistry and metallurgy.

By an agreement with the United States Bureau of Mines, the work of the metallurgical research department is under the direction of metallurgists of the bureau, assigned to duty at the university. A. E. Wells, metallurgist, is in charge of the work, assisted by other members of the metallurgical staff as follows: O. C. Ralston, metallurgist; J. C. Morgan, chemist; Dr. F. B. Laney, microscopist; and R. E. Head, metallurgical assistant.

Owing to the fact that Salt Lake City and vicinity is one of the chief nonferrous metallurgical centers of the United States and that the work taken up is of practical nature—that is, has to do with the solution of definite practical problems—the university believes that these fellowships offer a splendid opportunity to young men intending to enter the metallurgical profession, to thoroughly familiarize themselves with up-to-date metallurgical practice, especially in the treatment of nonferrous ores, and to become proficient in the adaptation of those processes which may be in line with the investigation carried on by them in connection with their work.

During 1916-17 the following problems have engaged the attention of those holding fellowships: A study of flotation processes in order to determine their applicability to the treatment of ores which are not at present treated by such processes, and especially the low-grade oxidized ores of lead and of zinc. A comparison of various flotation oils and the testing and preparation of new and more effective oils. The hydrometallurgical treatment of low-grade and complex ores of lead. The use of salt in the igneous concentration of low-grade lead ores from desert localities. The removal of iron from complex sulphides of zinc and iron. The preparation of pure solutions from oxidized ores of zinc. The chemical precipitation of solutions of zinc. Destructive distillation of some of the hydrocarbons of Utah, including gilsonite, elaterite, tabbyite, etc.

Holders of these fellowships will be subject to the rules governing employees of the United States Bureau of Mines and will report for duty for 12 months beginning July 1, 1917. They must also register as students in the University of Utah and become candidates for the degree of Master of Science in Metallurgy (unless this or an equivalent degree has been previously earned). Their class work will be directed by the heads of the departments of instruction, but the greater portion of their time will be spent in laboratory work, directed by metallurgists of the Bureau of Mines. Fellows are appointed for one year, but the appointment may be renewed. Joseph F. Merrill is director of the Utah State School of Mines, Salt Lake City.

British Mineral Production, 1916

An advance report (subject to revision) from the British Home Office gives the following figures of British mineral production in long tons, under the Coal Mines Act during 1916: Barium compounds, 8973; clay and shale (exclusive of fireclay and oil shale) 177,719; coal, 253,179,446; fireclay, 1,712,281; igneous rocks, 108; iron pyrites, 9496; ironstone, 5,648,602; limestone, 2477; ocher and umber, 44; oil shale, 2,994,386; sandstone (including ganister), 160,513.

Under the Metalliferous Mines Act, the following were produced: Arsenic, 2534 long tons; barium compounds, 60,468; bauxite, 10,329; chalk, 160; chert, flint, etc., 3202; clay and shale, 84,168; copper ore and copper precipitate, 937; fluorspar, 34,547; gold ore, 1338; gravel and sand, 8575; gypsum, 188,801; igneous rocks, 23,875; iron ore, 1,751,437; iron pyrites, 985; lead ore, 17,084; lignite, 500; limestone, 235,983; managnese ore, 5140; ocher and umber, etc., 4570; rock salt, 129,030; sandstone (including ganister), 32,174; slate, 46,184; soapstone, 301; tin ore (dressed), 6161; tungsten ores, 388; uranium ore, 51; zinc ore, 8476.

These figures do not in all cases represent the total mineral production, as the quantity of minerals including iron ore, limestone, etc., produced under the Quarries Act has not yet been reported. The totals for coal and for the ores of copper, lead and zinc are probably substantially complete.

Coal production in 1916 from mines under the Coal Mines Act was 256,348,351 long tons. The number of persons employed at mines under the Coal Mines Act was 998,063, and in mines under the Metalliferous Mines Regulation Act, 19,403.

History and Legal Phases of the Smelting-Smoke Problem—I*

By Ligon Johnson†

SYNOPSIS—Smoke troubles began to bother the Roman smelters in the Iberian Peninsula shortly before the Christian era. German smelting has always been under supervision of mining police. British Alkali Act not originally aimed at smelters but later amplified to apply to them. Bad effects of smoke from heap roasting lead to abandonment of heap roasting and to many developments and use of settling flues, smoke houses, dust chambers and cooling and slowing down flues.

Only the acute phase of the smelting-fume problem is new. The problem itself is older than the Christian era.

While both lead and copper were mined and crudely smelted 3000 years ago, it was not until the Roman occupation of the Iberian Peninsula and the British Isles, which occurred shortly before the beginning of the Christian era, that there was any evidence of smelting operations on a scale sufficiently large to permit a fume problem.

Around Huelva, Spain, are found more than 30 million tons of slag from lead smelting conducted there by the Romans. Pliny tells us that more than 20,000 slaves were employed in the Iberian mines. Extensive mining and smelting by the Romans in England and Wales were coincident with the Iberian proceedings.

These metallurgical operations were upon a sufficiently large scale to produce marked results both upon the surrounding country and the smeltery workers, but as they were those of a conqueror upon conquered soil, conducted by slaves, imperial Rome failed to recognize that such a thing as a smoke problem did or could arise, and whatever fume question there may have been at that time remained a question only to those who had no chance to answer any phase of it.

Early Roman, English and German Smelters

The smelting operations of the Romans extended over about 400 years, and little is recorded of lead and copper smelting from that time until the Sixteenth Century. From the revival beginning at this period up to the present century the growth of smelting has been comparatively gradual. In Great Britain smelting was conducted almost wholly in localities where metallurgical operations were of paramount importance, and the communities that grew up in smelting localities were due to and dependent upon the mines and smelteries. This fact had much to do with the comparative freedom of British smelting from burdensome fume litigation and legislation. To a lesser degree these conditions applied to the German operations which, when coupled with the further fact that most of the early German operations were to a greater or less degree fiscal workings of Prussia, Saxony and Brunswick-Hanover, accounts for the early immunity of German smelters. Topographically and with relation to fertile farm lands, the situations of the British smelteries were superior to the German, and ultimately a strong legislative barrier was erected around German operations, particularly in the case of new smelteries and under new sites of old plants.

Nowadays German smelting is, or at least was, prior to war conditions, under supervision of special officials in the nature of mining police and courts. Before construction of a smeltery could be begun, application for a permit had to be made, accompanied by general data as to situation, character, capacity, height of stack, character of ore to be treated and the like. Where a permit was once granted, it was not revocable, but notwithstanding the permit, if damage was done, the owner could be required to change methods and to install such appliances as would, so far as possible, prevent injury. Where a permit was refused, no smeltery could be built. The refusal of a permit by the *bergpolize,* or mining police, was not final, but an appeal could be had to the *berg gerict,* or Mines Court, and finally to the *ober berg gerict,* or Mines Court of Appeals, which was the tribunal of last resort. Incidentally, the *bergpolize* had inquistorial or supervisory powers not only as to damage to vegetation but also as to the safety of the works and the life and health of the employees.

British Alkali Act Applied to Smelters

It is supposed by many that the British Alkali Act was aimed at the smelting industry. This is far from correct. The original acts were directed chiefly at the manufacture of soda, acids and ammonia. In 1861 the House of Lords provided for an inquiry "into the injuries resulting from noxious vapors evolved from certain manufacturing processes, and into the state of the law relating thereto." While the investigation covered smelting as well as the other enterprises, the resulting act (the Alkali Act of 1863) covered only so-called alkali works and provided for the elimination of not less than 95% of the hydrochloric acid produced in alkali processes. By an amendment of 1874 it was enacted that not more than $\frac{1}{5}$ grain of acid should be contained in each cubic foot of gas escaping from the works.

The original act was made more comprehensive by amendments and revisions of 1874, 1881 and 1892, but other than operations under the wet copper process and certain zinc processes it was not until 1906 that smelting generally was included; and even then no actual regulation was provided, as the act so far as smelting was concerned merely declared that the inspectors under the act "may inquire whether in any works in which sulphide ores are calcined or smelted, means can be adopted at a reasonable expense for preventing the discharge from the furnaces or chimneys of such works into the atmosphere of any noxious or offensive gas evolved in such works, or for rendering such gas when discharged harmless or inoffensive."

No limitation was placed on smelting operations beyond inquiring as to the installation of such remedial

*A paper originally presented at a meeting of the New York Section of the American Institute of Mining Engineers, Jan. 26, 1917; to be formally presented at the St. Louis meeting, October, 1917.

†165 Broadway, New York, N. Y.

methods or appliances as might be installed at a reasonable expense. There was no prohibition as to tonnage or fume strength, and the first report of the inspectors touching on smelting was in the 44th annual report of the department for the year 1907, 45 years after the passage of the original act, and this embodies no smelter regulations.

Fume controversies and the attendant litigation and legislation are of comparatively recent origin in the United States. Probably the first thing in the way of legislation in this connection was the ordinance of Oakland, Calif., enacted in 1872, prohibiting the erection or maintenance of any smeltery within the corporate limits of that city. Subsequent California legislation was that of Contra Costa County limiting fume strength and by the state providing for a smelter commission to investigate the effect of fumes liberated in smelting operations. Efforts were also made to prohibit by legislative enactment the elimination of stack gases containing more than 0.2% sulphurous content. This proposed legislation, however, was defeated. There has been little legislation, either by the states or municipalities of the United States. Not until heap roasting of ores rich in sulphur was practiced on an extensive scale, was there any litigation of consequence in this country, and to the condition resulting from heap roasting may be charged no small amount of the prejudice by the farmers against smelteries and belief by them of the complete destruction of vegetation, animals and soil vitality through smelting operations.

The basis of this prejudice and belief is easily apparent, even to this day, in a visit to Butte, Mont., Shasta County, California, Duckton, Tenn., and places where heap roasting was extensively practiced.

Effect of Fumes From Heap Roasting

Under heap roasting, strong fumes in dense volume were liberated directly on the surface of the earth. These fumes were heavier than air and cold, being practically of atmospheric temperature. They did not float off in the atmosphere, but hugged the ground, rolling along in front of the wind in constant volume until absorbed by the soil and vegetation. There was little diffusion, and the radius of fume influence gradually widened with the destruction of each successive barrier of vegetation.

The topography of the country surrounding the roast heaps was, almost without exception, sharply declivitous, as the roasting operations were conducted in hilly and mountainous regions. The soils of the regions surrounding the smeltery sites were coarse and grainy, requiring the binder of the roots of vegetation and humus to hold the soil particles together.

The destruction of plant life adjacent to heap-roasting operations resulted not only in the loss of vegetable life above the soil, but of the roots below, and with every rain the top soil was eroded until large areas were made wholly barren, the top soil was washed away and only the decomposing rocks and mica were left. In consequence there was no soil in which vegetation could find a foothold, even when the fumes were no longer present. It was from this erosion that the belief of the killing of the soil first arose.

From what they could already see, the people around believed the smeltery smoke to be the veritable breath of the Upas tree which destroyed all within its reach and that this deadly agency was daily reaching farther and farther and in and upon the homes and farms surrounding the smeltery sites. Litigation was then not only threatened but instituted. First, the farmers sued the Tennessee and Ducktown companies, and upon the failure of these suits the State of Georgia took up the cudgel. The farmers in Shasta County, California, brought suit against the plants at Kennett and Coram; the Benecia residents and adjacent farmers sued the Selby smelter; the United States, by reason of the ownership of a forest reserve adjoining the Keswick plant, filed its bill against the Mountain Copper Co. Not long after this the Deer Lodge Valley farmers filed their suits against the Washoe company at Anaconda, and Salt Lake Valley farmers began proceedings against the smeltery operations in that valley.

With these suits developed the early so-called smoke experts. Most of them had been in the heap-roasting communities where the destruction of vegetation and soil erosion had followed the heap roasting. No definite knowledge of fume action was available, and the experts for both plaintiffs and defendants, in the absence of knowledge, began to form pet theories only to be met by pet theories of others directly at variance.

In the good old days of theory, an expert could make a casual inspection, or examine a few cross-sections of leaves under a microscope, or make a few comparative tests for the sulphur contents of healthy and unhealthy plants, and deliver an epic on what the fumes were and were not doing. The appearance of the country around the old roast heaps and early plants was too big a handicap for the smelters to overcome, and with the notable exception of the Washoe litigation, in practically every case an injunction followed.

About the time of the institution of these suits the smelters began the abandonment of heap roasting and the development of present-day operations. In this development prior theories expounded by the then experts or testified in the smeltery suits had considerable bearing. In one locality everyone was assured that the injury came wholly from the dust particles; in another, from the dust particles as the nucleus for minute drops of acid; in another, from sulphuric-acid vapor, which could be seen as a white fume cloud, and practically everything was blamed more than the chief, if not the sole offender, the SO_2. In many cases the courts followed these theories in their decrees.

First Developments to Obviate Smoke Effects

The first development went to long settling flues, smokehouses and dust chambers, cooling and slowing-down gases, and taking out so far as possible the solids and acid vapors. At the Tennessee plants acid making was attempted.

In most of the litigation, under readjustment to conform with decrees entered or modifications of these decrees—which modifications, as a rule, were secured under very substantial cash payments to the farmers—the smeltery secured a new lease on life. Several plants, however, such as the Balakalala in California and the Highland Boy at Salt Lake, were completely closed, and passed into history as smelteries. Most of the new installations, methods and readjustments provided by the decrees were in conformity with the theories of the experts in that particular case.

It is interesting to note that not only were the findings of fact in the different cases widely at variance, but

the conclusions of law in many instances directly in conflict, even in cases in different circuits of the United States courts. For instance, in California and Montana, the United States court held that the court could consider the balancing of conveniences; that is, that the court, in determining whether or not an injunction would be granted, could weigh the damage that would be done under closing a smeltery against the benefits the farmers would receive under an injunction. In the Federal court in Utah a directly contrary holding was made. In neither law nor facts did the courts coincide.

Some little time was required to make the plant changes to conform with the theories of the experts adopted by the court of the farmers, and still further time was required to demonstrate the effectiveness of the changes. Most of the theories failed to pan out, and gradually a new crop of complaints, and claims that the recent installation did not prevent the damage, began to grow. Some claimants were insistent. Plant managers, remembering the results of old litigation, sought to temporize instead of ascertaining the real facts and meeting them squarely. Some tried to buy peace.

Nothing in the Selby report is truer than the statement that "the policy that 'buys off' trouble as the most expedient commercial method for abating it has been responsible for much of the smelter litigation of this country and the intense ill feeling that unfortunately exists toward smelters in many smelter communities." It did not take long under this practice for the price of peace to rise to prohibitive figures, and a new epidemic of litigation was threatened.

Going back a little beyond this second period of threatened litigation and before the storm clouds of it were yet clearly over the horizon, I think that I may say that the smoke problem was then considered by most plant managers as the least of their troubles. Little or no thought or study was given the question, and when it was mentioned it was waived aside. The worst most of them feared was having to judiciously distribute a little peace money.

Smelteries Near Forest Reserves

A number of the smelteries, including the Washoe, Mammoth, Bully Hill, the old Mountain Copper, the proposed Engels smeltery and others, were either in or adjacent to National Forest Reserves, and numerous reports of damage or threatened damage began to come into the chief of the Forest Service and the Land Office. These reports were in turn referred to the Department of Justice. I was at that time special assistant to the Attorney General, and these reports were finally referred to me with instructions to prepare and file bills for injunction unless some satisfactory solution could be reached.

While it was probably unknown to the smelters generally at this time, it was never the intention of the Government to close any plant. What it sought was the immediate and serious consideration of the fume problem and active effort to correct harmful conditions where such existed. Only one suit was filed, and that was against the Anaconda plant. In each of the other cases stipulations were entered providing for research work and the installation of the highest types of methods and appliances known to smelting science or else the abatement of the operations producing fumes in harmful quantities until such appliances had been installed and proven elsewhere, upon which they were to be installed at the smeltery entering into the stipulation. In the Anaconda case the first scientific commission was agreed upon. We proposed that the smeltery operate under the best type of methods and appliances known to science and commercially feasible at the plant, and that a commission of John Hays Hammond, Dr. L. D. Ricketts and Dr. Joseph A. Holmes, chief of the Bureau of Mines, be designated as a commission to investigate and prescribe what changes or installations should be made under the agreement.

It was not long after this that the threat of further litigation by the farmers became ominous, and as I had completed my work with the Department of Justice so far as smelting matters were concerned, I resigned to become what might be termed smoke or field counsel for the American Smelting and Refining Co.

Selby Troubles With Benecia

The first urgent smoke matter in this connection was the Selby litigation between Benecia residents and the Selby plant, which had been pending a dozen or more years. A flat injunction against the operation of the Selby plant had been granted, which injunction had been fought through the courts and finally approved by the Supreme Court. The case had been through the court of last resort, and the injunction was to become effective in a month or six weeks' time. On examining the record, I found this suit to be somewhat different from the average smelter suit. Very little claim of injury to vegetation was made. More stress was placed on injury to animals, but the chief ground of complaint was excessive discomfort and alleged nausea and illness produced by the odors which witnesses uniformly declared "to smell like rotten eggs" or the sulphur spring of an adjoining county which gave off quantities of sulphureted hydrogen.

An examination of the Selby plant disclosed that, regardless of what lead loss there might have been at other times, under changes made or under way no lead loss would occur and therefore no possible source of injury to animals could exist from the plant's operations and that there was no appreciable amount of sulphureted hydrogen given off by or generated in the smeltery plant.

In the San Francisco region, in the spring and summer months constant trade winds blow, and these winds follow a direct line from the Selby smeltery to Benecia, where most of the complaining witnesses lived. Beyond the Selby plant, but also directly in line of the trade winds over the Selby plant, was a large oil refinery and asphalt works. The odors complained of by the witnesses all came in the early morning hours, and investigation disclosed that at the times involved in the testimony the oil and asphalt stills were not capped and were poured at 3 or 4 o'clock in the morning. Here, then, was a source of odors which traveled on the same winds that carried the Selby smoke. The smeltery was guilty of none of the things upon which the injunction was based. Capping the oil and asphalt stills practically disposed of the smells.

We notified the county attorney and commissioners of Solano County of these facts and said that we proposed to decline to observe the injunction prohibiting the operation of the plant. This would mean additional long drawn out and expensive litigation. To obviate such a situation, I proposed that the whole matter be referred to a commission of scientists of the highest type, the members to be agreed upon jointly, and the finding to be entered in the Selby case as the findings and decree in that

case. Every access to the plant and fullest facility for examination was to be given the commission. After many conferences an agreement along these lines was arrived at and the Selby Commission came into being. The members of the commission were Dr. J. A. Holmes, director of the Bureau of Mines, Dr. E. C. Franklin, then director of the chemical laboratories of the United States Public Health Service at Washington and Ralph A. Gould, a chemical engineer of San Francisco. With the Selby Commission came the first scientific research in smeltery fumes along the lines of normal field conditions. The examination of the commission extended over a period of about a year and a half and in the end clearly demonstrated that the smeltery was doing none of the things found against it in the original decree; and the injunction was vacated.

(To be concluded)

British Aluminum Industry

Some interesting remarks about the future of aluminum, and especially of the British aluminum industry, were made by Chairman A. W. Tait at the recent annual meeting of the British Aluminum Co., Ltd., which is the principal interest in this industry in the United Kingdom. Besides its plants in Great Britain, the company has reduction works in Norway and, at the outbreak of the war, a hydro-electric development and a reduction plant in Switzerland—on which work was suspended. Trade conditions were of course abnormal, the price of the metal being fixed by the government, a condition that will doubtless prevail until the end of the war. The company's profits last year, after deducting excess-profits tax, etc., were £379,519 (about $1,840,000), as compared with £312,546 (about $1,519,000) the year previous. Regarding the future of aluminum and of his company's activities, Chairman Tait said:

"While I am unable to give you any particulars of the uses to which the metal is at present being put, there is no doubt that the experience which is being obtained during the war, including the production of light alloys, will be of the greatest possible use in extending the field of development for the metal for ordinary commercial purposes. There is a strong probability that the motor-car industry, after the war, will manufacture their engines largely from aluminum because of its lightness and consequent saving in running costs and of its qualities of quick radiation of heat. Notwithstanding the enormous development that has taken place in the productive capacity for aluminum all over the world, particularly in the United States of America and in Norway, I am of opinion that it will not be long after the cessation of hostilities before the commercial development and expansion in the uses of the metal will take up this increased supply, and possibly also call for further production.

"So far as this company is concerned, we are at present pushing on with certain hydraulic works at Kinlochleven for the provision of additional water supply to the Blackwater reservoir from another catchment area, and we hope that part of the additional supply will be available by the middle of this year and that the whole of the scheme will be completed by the end of the year. This will, of course, increase our productive capacity. The work is at the present time of national importance because of urgent need for the metal in practically every branch of the service. Regulation works have also been proceeding for some time to increase the available water supply for our works at Vigelands, Norway, and from recent reports which we have received we should begin to obtain some benefit from this during the current year. A branch of the alumina works, which are absolutly necessary to take care of the increased production of aluminum, and to which reference was made at our last meeting, are now, I am glad to say, nearing completion. They have, of course, been much delayed in construction owing to the present ruling difficulties, particularly with regard to the supply of labor; but we are now able to announce that the power plant has been put into operation, and that we are proceeding at once to begin the manufacture of aluminum. The costs of production continue to be seriously affected by the further heavy increases that have taken place during the year in the costs of labor, material, freights and other charges and I am afraid that they will continue to rise so long as the present conditions remain.

"The maintenance of supplies of raw materials and coal required by our various works in Great Britain and Norway has been exceedingly difficult and has on many occasions caused us considerable anxiety, particularly as the greater part, if not the whole, of our freight is sea-borne. As the whole of our raw material—bauxite—has to be shipped from the south of France, we have constantly to make provision for possible contingencies. It is unfortunate that the large stock of bauxite which we have lying at Grasse in the south of France could not have been conveyed to this country before the war broke out, as it was our intention to do; but certain arrangements for storage on this side which were then in progress fell through. It is needless to say, however, that on the return of normal conditions we shall regard it as one of our essential duties to see that a large stock of bauxite is maintained in this country, to forestall any such contingency as has arisen during the present war. . . . The company's properties in Switzerland are being maintained in good condition, but no further construction work can be proceeded with until after the conclusion of the war. It is to be regretted that our government did not see its way to assist us to complete the development of that power and the erection of the necessary works in the early stages of the war, because if that had been done the factory could have been producing by this time a substantial amount of aluminum which would have been available for government purposes and would have reduced the necessity for purchases of metal in neutral countries. . . . The aluminum industry is undoubtedly one of the key industries of the country and well merits such assistance as the government can see its way to give. We have not only to consider the question of the development of that industry in the United Kingdom, but also within the empire, and I may say that there is a wide field within our domain which is capable of development. It is also necessary that there should be a speeding up on the question of research, and I am pleased to see that on this subject the government as well as the manufacturers are keenly alive to its great importance; and, as I have already mentioned, research in the aluminum industry, particularly on the subject of alloys, is of the greatest importance."

The Ridge Roasting Furnace is reported to be in satisfactory use for zinc ores at the works of Vivian & Son, Ltd., Swansea, Wales.

Consolidation of Trenches, Localities and Craters After Assault and Capture

SYNOPSIS—A complete description of the principles of consolidation of captured trenches, and craters, and the methods of making secure captured villages and woods, together with the part played by engineer troops in all of these, and the method of distribution of engineer detachments, and the preparation of engineer dumps.

In the March-April issue of *Professional Memoirs,* the official service publication of the Corps of Engineers, U. S. Army, was published an authoritative article on the title subject, which is valuable on account of the general interest taken in such matters at the present time, and specifically because of the importance of the engineer duties involved. It is therefore reproduced here in full for the benefit of the mining engineers who are preparing themselves for military work.

The capture of a system of hostile trenches is an easy matter compared with the difficulty of retaining it. A

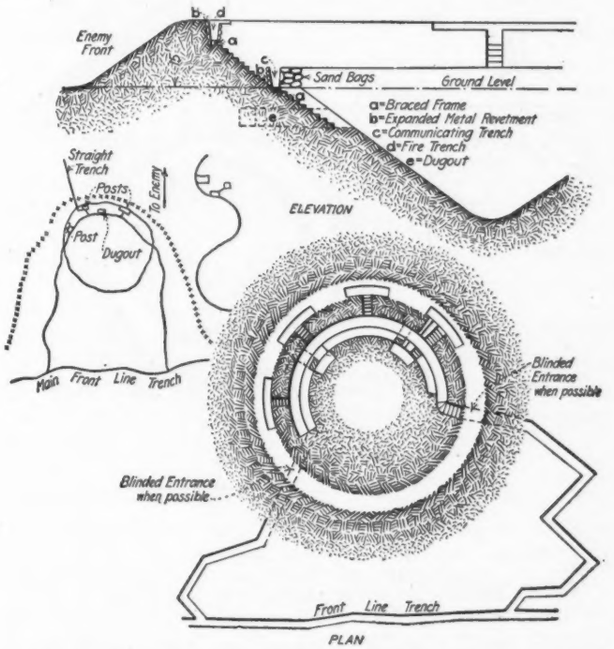


FIG. 1. DIAGRAMS AND SECTION OF CRATE WITH FRONT LIP PREPARED FOR DEFENSE

thorough knowledge of the principles, a careful study and correct use of the natural features of the ground and a detailed preparation and organization of the work are necessary; but success will result only if there is also an absolute determination on the part of all ranks to get the work done promptly at all costs.

The principles of the consolidation of captured trenches are, briefly, as follows: (a) To establish a series of strong points or centers of resistance, wired all around and mutually supporting one another according to the ground. These points should be provided with machine or Lewis guns at once. (b) To provide good communication to the rear from these points. (c) To fill in all hostile trenches within bombing distance of the points occupied. (d) To establish, if possible, simultaneously with the consolidation of strong points in the front line, a number of supporting points in rear. These points should, if the ground is favorable, be placed to cover the intervals between the works in the front line. (e) The strong points can later be connected to form a continuous front.

These principles must be applied with due regard to the natural tactical features of the ground. The satisfactory siting and consolidation of a position will largely depend on the power possessed by the officers on the spot to recognize during the various stages of a battle the minor features of real tactical importance. This ability is acquired only by previous training and is a quality which every officer must study to possess. The size and trace of the "strong points," as well as the intervals between them, will vary according to the lie of the ground and the plan of the hostile trenches captured. During the process of consolidation concealment from artillery observation is of importance.

The first essential is speed in rendering the captured position strong enough to resist the first counter-attacks. It is therefore necessary that a definite plan should be decided on beforehand as to which points first require attention. This can be done, in the majority of cases, with great accuracy from maps and aëroplane photographs and from a study of the ground from any point in our lines which commands a view of it. In the case of craters, the forecast of the tunneling officers must be obtained.

Although it is usually advisable that assaulting troops should be relieved as soon as possible, this must not be taken to imply that the duty of securing ground gained is the task only of the relieving troops. It is an unsound principle for troops to expect to be relieved immediately after an attack, as it wastes valuable time at a critical period when speed in work is essential. It must be understood that troops that take a position must begin the work of consolidation at once.

The distribution of engineer detachments requires to be carefully considered beforehand. In all cases of an assault or advance, where it is intended to secure the ground gained, the troops destined for the purpose should include a detachment of engineers, the commander of which should be detailed previously and attached to the staff of the unit or formation concerned. Garrisons must hold on to their ground; they have nothing to fear from being outflanked.

Consolidation of Localities

During an advance, when it became necessary to consolidate some locality of tactical importance, such as a village or wood, the same general principles hold good as in the consolidation of a system of trenches. Some notes on the particular points that require attention in the case of villages and woods can well be considered.

Enlargements from even small-scale maps give very accurate plans of most villages and make it possible to plan the defense in sufficient detail beforehand. It is essential that subordinate commanders should be provided

with such plans, in order that the general idea of the defense may be quickly and properly understood.

The order of urgency of work is as follows: (a) Barricade and picket all exits. Establish center of resistance near exits to cover approaches or any streams or tracks that might serve to guide a counter-attack. Begin work on keep, preferably at village crossroads. Barricade roads. (b) Reconnoiter for cellars. (c) Establish communications, giving cover from view, radiating from keep to outer centers of resistance and from keep to the rear. (d) Construct bombproofs in cellars at centers of resistance and keep—false roofs or cellars, etc. (e) Complete keep. (f) Improve communications at (c) to give cover from fire. (g) Make lateral lines of communication between centers of resistance.

Centers of resistance should be established (if it is possible to do so) to the flank of conspicuous buildings likely to afford good targets for hostile artillery fire. In the case of keeps in villages, this is often impossible owing to the presence of church spires. It is, however, preferable to have a keep, even with this disadvantage, that is central, accessible and strong against infantry assault. It should be remembered in this connection that by the time hostile infantry can assault a village keep, hostile artillery fire will necessarily have ceased.

As in the case of villages, plans should be prepared of wooded localities. There has been much discussion in the past as to what part of a wood should be occupied. Experience has proved that, owing to the great advantages afforded by cover from view, the position to take up in a wood is, just so far within the outer edge as will permit a good view into the open. In this connection it should be remembered that in course of time shell and rifle fire thins out the edges of woods considerably. It is therefore advantageous in the first instance to take up positions slightly in rear of those which may appear at the moment to be most advantageous.

If, as is often the case, the wood is surrounded by a hedge, there is a natural tendency to make trenches against this hedge. This is to be avoided. A hedge forms a very good obstacle against assault, with the addition of a little wire. If it screens the view it can be quickly thinned.

The order or urgency of work is as follows: (a) Establish centers of resistance for all-round defense at the corners and salients of the wood. These are the points that are most liable to counter-attack. Establish central reserve, reconnoiter, blaze and clear communications. The defense of the wood should be very active, and counter-attacks must be launched against any hostile troops that may reach the edge of the wood, in order to prevent a lodgment that places the enemy on equal terms. (b) Establish intermediate centers of resistance and lateral communication. (c) Establish central keep at junction of rides, or on near edge of clearing.

In the case of large woods and forests, where the general line of defense runs through a wood, a line of strong centers of resistance should be established across the wood, if possible behind a road or other clearing. The near edge of the clearing should be entangled, and the intervals between the "centers" should be swept by fire. As time permits, "rays" should be cleared, radiating from the centers of resistance and crossing similar "rays" from adjoining centers, so as to add to the depth of the field of fire. These rays should be wired and obstacles arranged so as to break up an attack and force the attackers into the openings. A line of intermediate centers, communications, etc., should also be established, as indicated in (b) above.

The occupation of craters and consolidation of mine craters presents many difficulties, and all ranks should understand the principles to be acted upon in the event of the explosion of mines on their front. Craters are usually formed as a result of one of the following mining operations: (a) An attack by us on the enemy's trenches; (b) an attack by the enemy on our trenches; (c) underground fighting. The possession of a crater offers the following advantages: (a) It can be turned into a strong point capable of holding a small garrison; (b) it gives command of the ground in the vicinity; (c) it froms a considerable obstacle.

When mines are exploded by us in connection with an attack on the enemy's trenches, our object should be to seize and hold the whole of the mine crater or craters, or a line in front of them. The latter plan is usually the best, and the craters in rear can then be turned into strong

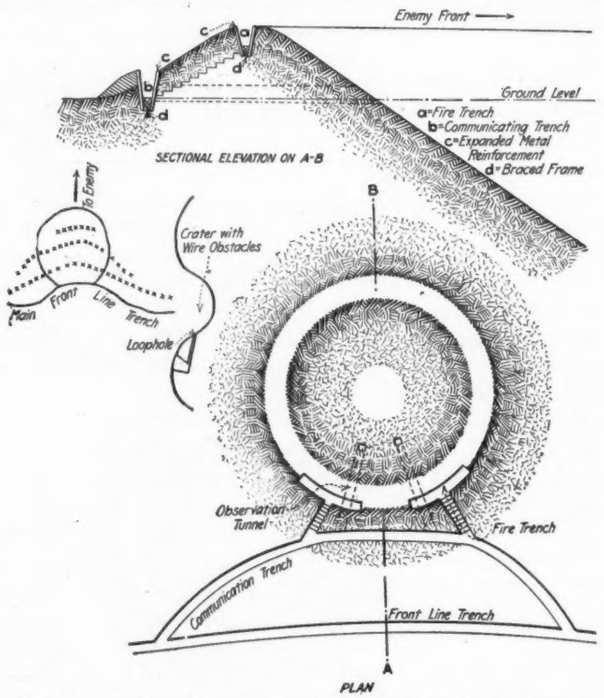


FIG. 2. DIAGRAMS AND SECTION OF CRATER WITH REAR LIP PREPARED FOR DEFENSE

points. When craters are formed as the result of an attack by the enemy on our trenches or in the course of underground fighting, our object will usually be to seize and hold the near "lip" of the crater. Parties must be rushed out at once to seize the lip. It may be impossible to open up communications to these parties till after dark. They should, therefore, take sufficient grenades, water, etc., and must be prepared to hold on though isolated.

Before the explosion of a mine a forecast should be made of the state of affairs to be expected after the explosion, and all details or probable requirements should be worked out. These would include: (a) The formation of dumps of engineer materials as close up as possible; (b) the organization of working and carrying parties.

Work should start immediately after the explosion of the mine, and no time should be lost in turning into account the quiet interval which usually follows the explosion. The personnel of engineer companies should be freely used for this work under instructions given through the General Staff.

The following are the main points to be attended to in the actual consolidation of the craters: (a) All trenches should be strutted as they are constructed. Special frames for this purpose must be made beforehand. (b) All works on a crater, whether inside or outside the "lip" should be provided with a parados. (c) Dugouts should be made by tunneling into the sides and not at the bottom of the crater. (d) At least two communication trenches should be constructed leading into each crater. Entrances to craters should be made at the sides and not through the rear "lip." (e) All trenches leading up to a crater from the enemy's line should be straightened or filled in for a distance of at least 40 yd. from the position of the defenders, so as to keep the

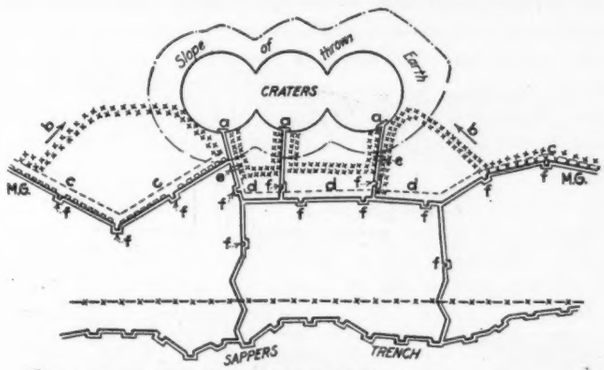


FIG. 3. LAYOUT OF SYSTEM OF DEFENSE BY BOMBING TRENCHES BEHIND CRATERS

enemy bombers at a distance. This work can usually be carried out with the least difficulty immediately after the explosion. (f) Collapsible knife-rests, French wire and other forms of portable wire entanglement should be brought up in large quantities and thrown over the "lip" of a crater.

There are two main methods of holding craters. The method usually employed after the explosion by us of a mine in the enemy's trenches or in the area where it is known that the enemy is not engaged in mining is shown in Fig. 1. The front "lip" of the crater is held by means of several posts. Two communication trenches lead into the crater, one on each side, and give lateral communication between the posts. One or two dugouts are constructed in the sides of the crater.

The method usually employed when the enemy has exploded a mine in or near our trenches, or when we have exploded a defensive mine close to our own trenches, is shown in Fig. 2. The rear "lip" of the crater is held. Wire is thrown inside the crater. One or two loopholes are cut through the rear "lip" so as to command the inside of the crater. In Fig. 3 is shown a scheme for converting into a strong post the area behind the lips of a series of craters that have been occupied. The importance of rendering the means of access to the lip secure from bombing attack is not always recognized.

Work should be carried out in the following order: (a) Construction of one or two posts in the "lip" of the crater; (b) wiring the front of posts and filling in or straightening trenches leading from it toward the enemy; (c) digging of communication trenches up to the crater. And, if far lip has been occupied—(d) Digging trench for lateral comunication inside the crater; (e) completion of wiring front of crater and construction of further posts in far "lip"; (f) construction of dugouts; (g) improvements to the above.

It should usually be possible to do (a), (b) and (c) together.

Copper Exports from Bolivia

American capital, according to *Commerce Reports,* of the United States Department of Commerce, Apr. 18, 1917, is contributing efficiently to the increase in the Bolivian copper production, and this fact, coupled with the activities of the many small producers who possess many facilities for exploiting the deposits for which they need no large amounts of capital, will tend to increase the interest in this mineral, which constitutes one of the most positive sources of Bolivia's natural wealth. The lack of adequate transportation facilities on the Arica-La Paz railway, the only line crossing the copper-producing center, prevented the exportation of much larger quantities of this ore. In addition the heavy export duties militated against shipments of ore to foreign countries.

By the law of Jan. 17, 1914, the Bolivian government withdrew the 25% export duty on nonconcentrated copper ores, with the result that the exportation of these ores rose from 4794 metric tons in 1914 to 17,945 tons in 1915. The copper-mining industry was greatly benefited by this exemption from duties and by the high prices obtained during 1915.

The exportation of concentrated copper ores also showed considerable improvement, increasing from 3874 metric tons in 1914 to 5868 tons in 1915.

Of the total of 17,945 metric tons of nonconcentrated ores exported in 1915, 13,777 tons went to the United States, 4000 tons to Great Britain, 24 tons to France, and 20 tons to Chile; and of the 5868 tons of the concentrated ores, Great Britain bought 2865 tons, the United States, 2246 tons, and France, 757 tons.

The production of copper ores, the total amount of which was 23,813 metric tons, is the largest on record in Bolivia, and in view of the improving prices, it is certain that the development will continue along more satisfactory lines.

Mining Concession in Peru

The Peruvian government has granted a concession for explorations for auriferous ore in the rivers of Marcapata, Nusiniscato, Huayllumbe and Crayumayo, acording to a note published in *Commerce Reports,* Washington, D. C. The concessionaire, Juan C. Diaz, will begin explorations in the beds and banks of these rivers and their affluents within six months, and terminate the work within two years. *El Peruano* gives the terms of the concession, stating the privilege of the concessionaire to work certain of the auriferous deposits, with the payment of 10% of the net profits from such mines to the government.

Nevada Consolidated Copper Co.

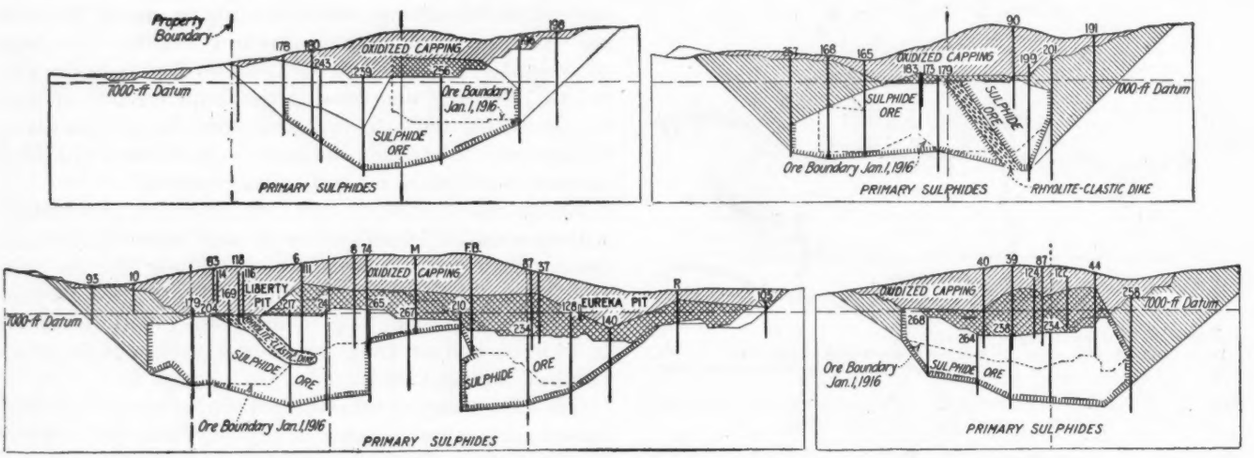
The annual report of the Nevada Consolidated Copper Co., Ely, Nev., shows the most successful year in the history of the company. The net earnings for 1916, which far surpass those of any previous year, are due to increased production and the higher prices that prevailed for copper metal. The earnings are computed on the basis of 25.83c. per lb., versus 17.647c. for the preceding year. No copper available for delivery remained unsold at the end of the year. The net production of copper was 90,735,287 lb., as compared with 62,726,651 lb. for the preceding year, an increase of over 44½%, and represents the possible future production under normal conditions.

Notwithstanding production for 1916 was greater than 1915, the operating expenses were also higher, owing to increased cost of labor, supplies, taxes, etc. The net cost of producing electrolytic refined copper f.o.b. Atlantic Seaboard, including plant and equipment depreciation and all charges except that for ore extinguishment, and after crediting all miscellaneous earnings, was 8.86c. per lb. versus 8.23c. for the preceding year. Excluding the item of depreciation, the cost was 8.13c. per lb. as compared with 7.45c. for the year ended Dec. 31, 1915.

During the year $586,936 was spent for improvements to the Steptoe plant and there was written off for depreciation $677,306 and for extinguishment of orebodies $393,711, which resulted in a net decrease of $484,081 in the book value of the total property and equipment. The expenditures for stripping overburden at the pits and for development of the Ruth mine were $1,989,989, of which $1,191,121 was charged to operating costs, making an increase in deferred charges of $798,868 to be charged against future operations. The total balance thus deferred at Dec. 31, 1916, was $4,935,838. The total cost of mine, plants, equipment, stripping and development to Dec. 31, 1916, was $26,140,007 and of this amount there had been written off against profits $11,914,051, leaving the balance still carried on the books as $14,225,956.

The net profit for the year available for dividends amounted to $15,435,359, or $7.72 per share; of this, $3.75 per share, or $7,497,963 was paid in dividends, $0.22 per share, or $433,309 was written off to cover ore extinguishment and depreciation, and $3.75 per share, or $7,504,087 was added to earned surplus. This increase in earned surplus is represented principally by the increase in metals on hand and in transit, $4,266,184, and increase in cash and marketable securities, $2,619,685. The total dividend disbursements to Dec. 31, 1916, were $25,474,399, which, together with $1,999,457 paid from surplus account, brought the total distrubuted to stockholders to Dec. 31, 1916, up to $27,473,856.

Churn-drill prospecting of both the Ruth underground area and Copper Flat shovel-pit area was energetically conducted during the year, the Ruth drilling being done mainly for the purpose of more definitely outlining the orebody as a preliminary to future mining operations, while in the Copper Flat area the prime object was to increase ore reserves. The results of all this drilling were highly satisfactory from both the point of additional ore developments and that of the information desired for the proper laying out of plans for economic ore extraction. The footage drilled during the year was as follows:



VARIOUS CROSS-SECTIONS THROUGH NEVADA CONSOLIDATED STEAM-SHOVEL OREBODIES

	Holes	Footage	Average Depth
Ruth group claims	42	19,704	469.05
Copper flat group	61	25,518	418.22
Total	103	45,222	439.04
Drilled previous to Jan. 1, 1916	381	124,316	326.29
Grand total Dec. 31, 1916	484	169,538	350.28

In the Ruth group drilling, 9 holes totaling 409 ft., were drilled from the floor of the 500-level drifts with an electrically driven churn drill of local design. The footage of underground work driven in the Ruth mine during the year was 33,321, making a total to Jan. 1, 1917, of 54,188 ft. Of this total, 32,868 ft. was caved as the mining operations progressed, leaving 21,320 ft. still open.

The new ore-tonnage developments occurred principally in the Copper Flat group and were brought about by deeper drilling in the shovel-pit area below the zone of distinct secondary enrichment into ore of good economic grade. Special geological investigations have resulted in classifying the mineralization in these deeper zones as of primary origin. The attached table gives a summary of ore reserves at the close of the fiscal year. The ton-

nages as stated are based on a complete revision of sections calculated and estimates.

	Ruth		Copper Flat		Total	
	Tons Ore	% Cu.	Tons Ore	% Cu.	Tons Ore	% Cu
Total developed ore to Dec. 31, 1915	14,357,750	2.32	60,933,454	1.50	75,291,204	1.65
Added during year 1916	1,468,922	1.50	13,006,597	1.37	14,475,519	1.38
Total developed to Dec. 31, 1916	15,826,672	2.24	73,940,051	1.48	89,766,723	1.60
Ore milled to Dec. 31, 1916	677,574	2.19	21,096,032	1.65	21,773,606	1.67
Recoverable ore remaining Dec. 31, 1916	15,149,098	2.24	52,844,019	1.41	67,993,117	1.59

The balance of tonnage shown as remaining at the end of the year will not check with the figures given in the annual report for 1915 because of some arbitrary deductions both as to grade and tonnage which it was considered advisable to make in connection with the 1915 estimates. The figures now stated do not consider such deductions, being based as they are upon more thorough development and accurate knowledge as to the extent, character and value of orebodies. In estimating tonnage all ore has been included up to the vertical boundaries of the orebodies as shown on sections, because the ore in the slopes heretofore mentioned as unavailable for steam-shovel mining on account of excessive overburden, can be successfully and profitably mined by underground-shrinkage methods and delivered direct to standard ore cars placed on the steam-shovel tracks at the toe of the slopes.

The stated ore reserves do not include approximately 155,800 tons of developed ore remaining in the Veteran mine. Neither do they include in the statement of ore milled 641,169 tons, averaging 2.69% copper, produced from that mine after it was acquired by this company, Oct. 1, 1910, to Nov. 30, 1914. Furthermore, no consideration is given in the statement of ore reserves to approximately 210,000 tons of carbonate ore of a profitable grade which has been mined and stored in stockpiles at the mine, or to large additional quantities of this kind of ore which will be mined in the future. This class of material is used for fluxing and other purposes in smelting operations and has a substantial value which, however, cannot be definitely stated except as it is used. During the year 1916, there was 79,963 tons of this oxidized ore, averaging 3.1% copper, smelted and sold at an average profit of approximately $3.70 per ton.

Prospect drilling will be continued during 1917 for the development of further extensions of orebodies known to exist.

During the year operations were continued in the Ruth mine, and in December the production was brought up to an average of about 2500 tons per day. The shrinkage-stope system of mining was gradually displaced by the branch-raise caving system, as the latter was found to be better adapted to the peculiarly soft ore and heavy ground in this deposit. The principal difficulty with the shrinkage-stope system was met in keeping the horizontal workings open when so near the zone of active mining. While this difficulty could be successfully combatted, it involved heavy upkeep expense. The branch-raise system permits placing the extraction drifts from 40 to 80 ft. below the zone of active mining, and so far in its use it has been much less difficult and expensive to maintain the horizontal workings. During the year 591,545 tons of ore averaging 2.195% copper was shipped from the Ruth mine to the concentrator.

Steam-shovel operations were conducted as usual in what is now one pit, the two original pits having been connected. The greater part of the tonnage was taken from the central and western portions, formerly known as the Hecla and Liberty areas. The amount of sulphide concentrating ore shipped during the year was 27.65% greater than in 1915, and was made up as follows:

	1915		1916	
	Tons Ore	% Cu	Tons Ore	% Cu
Pit ore	2,991,782	1.52	3,337,570	1.532
Ruth Mine ore	86,029	2.28	591,545	2.195
Total	3,077,811	1.54	3,929,115	1.632

In addition, 79,963 tons of siliceous carbonate ore averaging 3.1% copper was shipped direct to smelteries—45,591 tons to the company's smeltery and 34,372 tons to Garfield, Utah.

The amount of capping removed for the year was about 44% greater than in 1915. The large increases of ore reserves will necessitate a continuance of aggressive stripping operations for several years.

		Cu.Yd.
Total capping removed to Dec. 31, 1915		17,675,637
Total capping remaining to be removed Dec. 31, 1915		18,301,310
Yardage increase due to 1916 developments		10,705,099
Total capping estimated to Dec. 31, 1916		46,682,046
Total yardage removed to Dec. 31, 1915	17,675,637	
Total yardage removed during 1916	3,988,655	
Total yardage removed to Dec. 31, 1916		21,664,292
Total yardage remaining to be removed		25,017,754

From this it is seen that about 46% of the total capping of existing ore reserves has been removed, leaving about 54% still in place.

The total mining cost by steam shovel of concentrating ores was 23.70c. per dry ton. Of this amount 11.28c. is Federal, state, county and Federal corporation income taxes, leaving a balance of 12.42c. per ton, which covers all other charges—labor, supplies, repairs, management and a proper portion of New York and Nevada overhead charges. In 1915 this mining cost was 15.24c. per ton, of which 4.08c. per ton was for the previously mentioned taxes, all of which are charged to mining, leaving a balance of 11.16c. per ton to cover the direct mining cost. There was, therefore, an increase in the direct mining cost for 1916 of 1.26c. per ton, equivalent to 11.29% over the cost obtained in 1915. A charge for the retirement of stripping suspense account was added to the actual mining cost on the basis of 30c. per ton of ore removed, thus making the total mining cost charged to operations 53.70c. per ton of steam-shovel ore for 1916. The stripping cost for 1916 was 30.09c. per cu.yd., as against 28.85c. in 1915, an increase of 1.24c. per yard, or 4.3%. It may be stated that the increased percentage in the cost of labor and supplies was much greater than that of the per ton and yard costs shown. The cost of mining carbonate ore in the pit for the year was 37.3c. per ton, as against 46.1c. in 1915.

Underground mining in the Ruth orebody cost an average of $1.2021 per ton. Of this amount 14.04c. per ton represents the same kinds of taxes as previously mentioned, thus leaving a balance for direct mining of $1.0617 per ton. Here again the increased cost of labor and supplies was an important item, except for which the direct mining costs would have been less than $0.90 per ton. The costs of underground mining are gradually decreasing and will continue to do so as larger tonnages are produced and more systematic operating conditions applied. A new and heavier hoist and a duplicate compressor now being purchased will be installed early in

1918, when the Ruth mine will be prepared to supply 5000 tons daily. The average cost of prospect drilling at Copper Flat was $2.8522 per ft.; of bench drilling for blasting $0.3867 per ft. The average cost of prospect drilling in the Ruth was $2.3695 per ft.

At Ward Mountain a new pipe line 10,300 ft. long was completed during the early part of the year and put in service for the improvement of water supply. During the year 6300 ft. of new track was laid for the Keystone dump, and 1200 ft. of new track was laid for miscellaneous purposes around the mine. The total amount of track for the pit mine is 20.69 miles and includes 6.47 miles of Nevada Northern Ry. track, which is used in pit operations. One 55-ton locomotive for use at the pit mine was received, and two 81-ton locomotives were ordered. Several items of miscellaneous repair and shop equipment were provided. At the Ruth mine a new compressor was installed and many additions were made to mine-haulage and shop equipment. Increasing numbers of employees at both mines required the building of 22 dwellings, five staff and bunk houses, a new hospital to replace one destroyed by fire and one more schoolhouse.

All preparations for additional tonnage which is to be treated at the concentrator, beginning June 1, 1917, have been made, and the mines are ready for any increased output that they may be called upon to deliver.

Concentrating and Smelting

During 1916 many improvements at the concentrator were made, for the purpose of increased tonnage and improved recoveries. These consisted principally in the replacing of Huntington and chilean mills with tube-mill type regrinding equipment. A considerable number of double-deck tables and other apparatus were installed for the purpose of increasing concentrating capacity. The old coarse-crushing department of the concentrator is inadequate for the present plan for milling about 14,000 tons daily. In order to meet this requirement the construction of a new coarse-crushing plant was started in July, 1916. This will be operating by June 1, 1917. The total tonnage milled during 1916 was 3,922,634 tons, averaging 1.632% copper, with an actual mill extraction of 73.87%, the ratio of concentration being 7.45 and the average copper in concentrates, 8.98%.

The following table gives the concentrator results for the 1916 fiscal year by quarters:

	Percentage Recovery	Lb. Copper Recovered per Ton Ore	Grade of Concentrate, %
First quarter	73.28	24.31	9.142
Second quarter	73.28	23.03	9.229
Third quarter	73.95	24.89	8.881
Fourth quarter	74.52	24.36	8.721
Average for year	73.87	24.12	8.983

Total milling costs for the year were 55.9c. per ton, as against 53.3c. for 1915. The mill tonnage treated and the copper produced in concentrates by quarters as compared with 1915 fiscal year were as follows:

	1915		1916	
	Tons Milled	Lb. Copper in Concentrates	Tons Milled	Lb. Copper in Concentrates
First quarter	564,834	11,847,318	827,880	20,131,434
Second quarter	849,155	16,296,369	1,094,879	25,210,618
Third quarter	837,374	19,370,660	1,020,546	25,398,606
Fourth quarter	830,157	19,159,697	979,329	23,856,912
Total for year	3,081,520	66,674,044	3,922,634	94,597,570

In addition to the tonnage treated, as stated, the Consolidated Coppermines shipped to the mill during the year 50,911 tons of 1.593% ore. This was concentrated and the resultant product smelted under toll contract.

In the roasting department necessary changes in flue connections were made and four new roasters constructed and put in operation late in the year. The 18 furnaces previously installed were remodeled to further increase the capacity of the plant.

No changes of importance were made in the reverberatory and converter department, but plans are being prepared discontinuing the use of oil and substituting powdered coal as reverberatory fuel. This change is made necessary by the increasing prices of oil and the consequent impossibility of arranging for a satisfactory oil supply at permissible prices after the expiration of existing contracts.

In the powerhouse department a 20,000-cu.ft. per min. steam-driven turbo-blower was installed to supplement the blowing engine in supplying air for converter and other purposes. A 2000-cu.ft. two-stage steam-driven air compressor was installed as an auxiliary to the high-pressure air system required for shop work, and a 3000-kw. turbo-generator was ordered to cover the power demands of the concentrator, in line with the increased mill tonnage contemplated. Owing to the enroachment of the slag dump on the springs which constitute a part of the plant water supply, the hydro-electric pumps were removed to a permanent position and a new pumping engine has been purchased for increasing deliveries of water from this source.

The production of refined copper resultant from the year's operations was 90,735,287 lb., as compared to 62,726,651 lb. for 1915. The net operating cost per pound of copper produced was 9.44c. Miscellaneous earnings for the year amounted to 1.31c. per lb., which, if deducted from the actual operating cost, as stated, leaves a final net cost of 8.13c. per pound.

Nevada Northern Ry. Construction and Betterments

During 1916 the total length of all tracks was increased to the extent of 1.557 miles. The total mileage at the end of the year was as follows: Main line and branches, 165.01 miles; yard and siding tracks, including all terminals, 26.257 miles; total length of tracks, 191.267 miles.

There were no extensive improvements during the year and no equipment was purchased, but one 80-class locomotive was ordered in December, which should be delivered in May, 1917. The equipment at present consists of 15 freight and passenger locomotives, 14 passenger-train cars, 345 ore and other freight-trains cars, 14 work-train and maintenance-of-way cars, 1 wrecking crane, 1 coal crane and 1 snowplow.

The total freight handled for the year was 4,845,894 tons, or an average of 13,240 tons per day, as compared with 3,789,356 tons and an average of 10,382 tons daily during 1915, being an increase of 27.9%. Of this tonnage 4,366,528 tons was ore, 4,307,830 tons having been shipped by the Nevada Consolidated Copper Co., and 58,698 tons by other producers and leasers in the district. The remaining 479,366 tons consisted of commercial freight, as compared with 359,699 tons of such freight handled in 1915.

The total number of passengers carried in both main-line and suburban service during the year was 368,577, a daily average of 1009 as compared to a total of 288,736 for 1915, an increase of 28%.

Kennecott and Braden Annual Report

The annual report for 1916 of the Kennecott Copper Corporation, with which is combined that of the Braden Copper Mines Co., states that during the year there was mined at Kennecott, from the Bonanza and Jumbo mines 297,843 tons of ore averaging 18.69% Cu. Production from this tonnage mined was as follows:

Class	Dry Tons	Per Cent. Cu	Cu Tons Content
High-grade ore	48,855	67.9	33,166
Second-class ore	19,271	15.6	3,008
Concentrates	29,949	53.6	16,039
Precipitates	703	69.9	492
Total	98,778	53.36	52,705

There was mined from the Beatson mine, Latouche Island, 184,411 tons of ore averaging 2.30% Cu. Production from ore mined was as follows:

	Dry Tons	Per Cent. Cu	Cu Tons Content
Concentrates	20,701	14.29	2,958
Direct shipping ore	6,608	7.23	478
Total	27,309	12.58	3,436

There was therefore produced from the corporation's Alaskan mines during the year a total of 126,087 tons of shipping ore and concentrates containing 56,141 net tons, or 112,282,000 lb. of Cu, or an average copper tenor of 44.53% per ton.

Milling Operations and Leaching

At the Kennecott plant 229,717 dry tons of ore averaging 8.49% Cu was milled during the year. Concentration ratio was 7.67. Concentrates produced amounted to 29,949 tons of an average grade of 53.6% Cu. The average recovery was 82.27%.

Ore milled at the Beatson plant amounted to 177,803 dry tons of an average assay of 2.12% Cu. Concentration ratio was 8.59. Concentrates produced amounted to 20,701 tons of an average grade of 14.29% Cu. The average recovery for the year was 78.91%.

Operations at the ammonia leaching plant erected at Kennecott for the treatment of mill tailings, were started during the early part of the year and were continued with increasingly gratifying results; 62,450 dry tons of tailings assaying 1.48% Cu was leached. Precipitates produced amounted to 703 dry tons of an average assay of 69.9% Cu. Plans and specifications are now being prepared to increase the capacity of the leaching plant from 300 tons per day to 700 tons.

Plans and estimates for increasing the Beatson concentrator from its capacity of approximately 700 tons per day to 1500 tons were completed and approved, and the construction of this increased plant at a cost, including necessary additions and improvements in connection therewith was authorized. It is anticipated that the plant will be on a 1500-ton basis by the early fall of 1917.

There was received at the smeltery during the year, after allowing for smelter deductions, 108,372,783 lb. of deliverable refined copper. Total cost of production per pound of copper was 5.10c. Detail of this total follows:

Mining and milling	1.47
Freight to smeltery	2.49
Smelting and refining	1.39
Selling expense	.26
General expense	.04
Marine insurance	.15
Proceeds silver contents	.65*
Miscellaneous earnings	.05*
	5.10

* Deduction.

During the year 56,970 shares of Braden Copper Mines Co. stock was acquired through the issuance of Kennecott Copper Corporation shares in exchange therefor at the rate of one share of Kennecott stock for 3¼ shares of Braden stock. Braden Copper Mines Co. bonds acquired by the corporation pursuant to its offer of Dec. 15, 1915, to Braden stock- and bond-holders were converted by the corporation into Braden stock, and the corporation owned on Dec. 31, 1916, 2,564,650 shares of Braden Copper Mines Co. stock out of a total of 2,590,706 shares.

There was acquired during the year 2902¾ additional shares of the Alaska Steamship Co., through the issuance of shares of the Kennecott Copper Corporation therefor at the rate of two shares of Kennecott stock for one share of Alaska Steamship Co. stock. A 50% stock dividend in addition to cash dividend was paid by the Alaska Steamship Co. Dec. 30, 1916. The corporation therefore owned, at the close of the year, 23,854.125 shares of Alaska Steamship Co. stock of a par value of $100 each out of a total outstanding issue of 45,000 shares.

The net earnings of the Alaska Steamship Co. for the fiscal year ended Dec. 31, 1916, after allowing for depreciation and all charges, were $1,211,322. Of this amount $561,947 represents profit from sale of the S.S. "Seward," leaving actual net earnings from operations of $649,375. Cash dividends aggregating 8% for the year were paid in addition to the stock dividend of 50% already mentioned. This stock dividend increased the outstanding capital stock of the Alaska Steamship Co. to $4,500,000. To care for the rapidly increasing business of the company, there were purchased during the latter part of the year, at a total cost of $910,000, the "Stanley Dollar" and the "Henry T. Scott," steel freighters of a carrying capacity of approximately 2500 tons each. There were no vessels lost during the year and no accidents of serious import.

Operations of the Copper River & Northwestern Railway Co. during the year were satisfactory. To supplement its present equipment, orders were placed in the latter part of the year for one Mikado-type freight locomotive and 40 steel flat cars. Operating income for the year was $1,768,671.

The Kennecott corporation has large holdings in the Utah Copper Co., the annual report of which was published in the *Journal* of Apr. 28.

Dividends of $5.50 per share, amounting to $15,320,283 were paid during the year to the holders of 2,786,679 1/13 shares of stock outstanding.

Braden Copper Mines Co.

During 1916 efforts were directed toward obtaining the maximum output of copper, together with the completion of plans for plant extension to 10,000 tons per day, and the inauguration of actual construction work, which is now actively under way. During the year 51,230 ft. of development work was done in the mine, which added greatly to the tonnage of ore previously reported as in sight and partly developed.

An estimate made Nov. 17, 1916, by Fred Hellmann, consulting mining engineer of the company, gave the following tonnages of ore under the various classifications of development:

ESTIMATED ORE, 1916

131,680,000 tons of positive ore averaging 2.40% of Cu
88,000,000 tons of probable ore averaging 1.89% of Cu

219,680,000 tons, of an average value of...2.19% of Cu

These figures may be compared with the following estimates of developed and probable ore as of Jan. 1, 1915:

ESTIMATED ORE, 1915

66,225,590 tons of developed ore averaging 2.94% of Cu
20,220,026 tons of probable ore averaging 2.72% of Cu

86,445,616 tons, of an average value of.....2.88% of Cu

This shows an increase in positive ore of 65,454,410 tons and a corresponding increase in copper contents of 1,213,288 tons. This is equivalent to an increase of 62.3% of the gross copper contents of the ore actually in sight in 1915.

The large amount of positive and probable ore and the probable eventual extension of plant capacity beyond 10,000 tons of ore per day made it advisable to change the proposed site of the new smelting plant from Sewell to Caletones, which is close to a point on the Braden railroad about seven miles from Sewell by railroad, or four miles in a direct line. Plans now under consideration contemplate the transportation of concentrates from the mill to the new smeltery site by means of an aërial tramway.

In June, 1916, a serious accident to the main tailings dam not only greatly interfered with the production during the second, third and fourth quarters, but forced the immediate necessity for making other and more comprehensive plans for tailings disposal. These changes and other additional improvements deemed necessary for continuous and economical operation, together with increased cost of labor, freight and materials, have added greatly to the amount of money previously considered as necessary to bring the plant up to a capacity of 10,000 tons per day.

The following comparative table gives the more important mining and metallurgical data covering the year's operations of the Braden Copper Co., together with the cost of and price realized for copper produced. Costs are calculated before deducting depreciation or losses due to writing off obsolete plant accounts.

Period	Tons Blister Copper Produced	Dry Tons Ore Treated	Daily Average	% Cu in Ore Treated	Dry Tons Concentrates Produced	% Net Saving	Net Cost per Pound of Copper at the Plant
1st quarter.....	5,212	371,852	4,086	2.154	33,921	75.74	6.80c.
2nd quarter.....	5,118	337,674	3,711	2.012	26,961	74.11	8.34c.
3rd quarter.....	4,167	259,806	2,824	2.101	22,298	74.48	10.04c.
4th quarter.....	6,579	393,297	4,275	2.217	34,804	75.58	7.48c.
12 Mos. 1916....	21,076	1,362,629	3,723	2.127	117,984	75.07	8.03c.

The average net price realized by the company for copper produced during the year 1916 was 26.35c. per lb.

Mining in Mysore, India

Some interesting extracts from the official report on mining operations in the native state of Mysore during 1915-16 appeared recently in the Indian (Government) *Trade Journal,* and were noted in *Commerce Reports,* Washington, Apr. 5.

The output of bar gold was 558,381 oz., against 570,886 oz. in 1914-15. The quantity of chrome mined was 1376 tons. Little work was done to exploit mica, as there was not much demand for the class of the mineral available. In one district 3½ tons of antimony was collected and stored; this is chiefly sulphide ore sorted out from a large quantity of quartz material. Corundum to the amount of 500 cwt. was collected, but there was no export of the mineral during the year.

As regards iron ore, the prospecting work done at the Kemmangundi areas gave satisfactory results and 1311 tons of ore was excavated, stacked and sampled. A large body of what appears to be high-grade ore was opened up, from which at least half a million tons may be expected, and other masses likely to yield a large quantity of lower or more-mixed grades have also been shown to exist. It was discovered that considerable quantities of ferruginous bauxite exist associated with iron ores of the Bababudan Hills. Prospecting work was continued on the limestone deposits of the Tumkur district. It was found by analysis that there were two varieties of magnesia of high and low admixture. Certain areas where the amount of silica is fairly low were located for this mineral, and about 20 tons of the two varieties were excavated for experiment purposes.

Samples of slate quarried in the Tumkur district showed that only the fine chlorite and argillaceous schists could be split into thin slates. Some experimental work was carried out for the preparation of dead-burnt magnesia and magnesia bricks, and the results were satisfactory. A design for an experimental kiln was made and sent to the Tata Iron and Steel Co., with a view to its erection in Bangalore for further experiments. A quantiy of Mysore magnesite was tested for the manufacture of epsom salts, but the cost of sulphuric acid to be employed in its manufacture would, even in normal times, be equal to the market value of the salt itself.

The deposits of kaolin at Kekri, Asgod and Kokkod were prospected and sampled. They might be useful for local porcelain or pottery work or for the manufacture of firebrick. Several tons of asbestos was obtained from the Hassan district and fiberized in an impact pulverizer. The yield was a fluffy fiber which is very short and of low tensile strength and unsuitable for many purposes.

An investigation was made as to the possibilities of extracting clean sodium carbonate from the alkaline deposits near Mandya and other places, but no conclusive results have been obtained. The other mineral products to which attention was paid during the year were antimony, lead, zinc and silver ores, pyrites, sulphuric acid, calcium cyanide, electrolytic alkali and bleach, graphite, ocher, and sands and other materials for glass making.

Tungsten and Antimony in Bolivia

The American minister to Bolivia, according to *Commerce Reports,* of the United States Department of Commerce, of Apr. 18, reports that the enhanced prices obtained for tungsten ore have caused the opening up of large deposits in the northern part of the country, where they abound. The output during 1914 was 276 metric tons, while in 1915 the exports totaled 792½ tons, an increase of 516½ tons, or 349%, for that year, when the United States took 436 tons and Great Britain 357 tons.

The production of antimony during 1915 was above the most optimistic calculations. Exports increased from 186 tons in 1914 to 17,923 metric tons in 1915, when 16,184 tons went to Great Britain, 1589 tons to the United States and the remainder to Spain. The large number of deposits of this mineral and the ease of its exploitation bring large profits to the mine owners at the present prices, and there is no reason why this industry should not become one of the most flourishing in the country so long as the quotation on the ore is at all reasonable.

Organization of Government Machinery for War

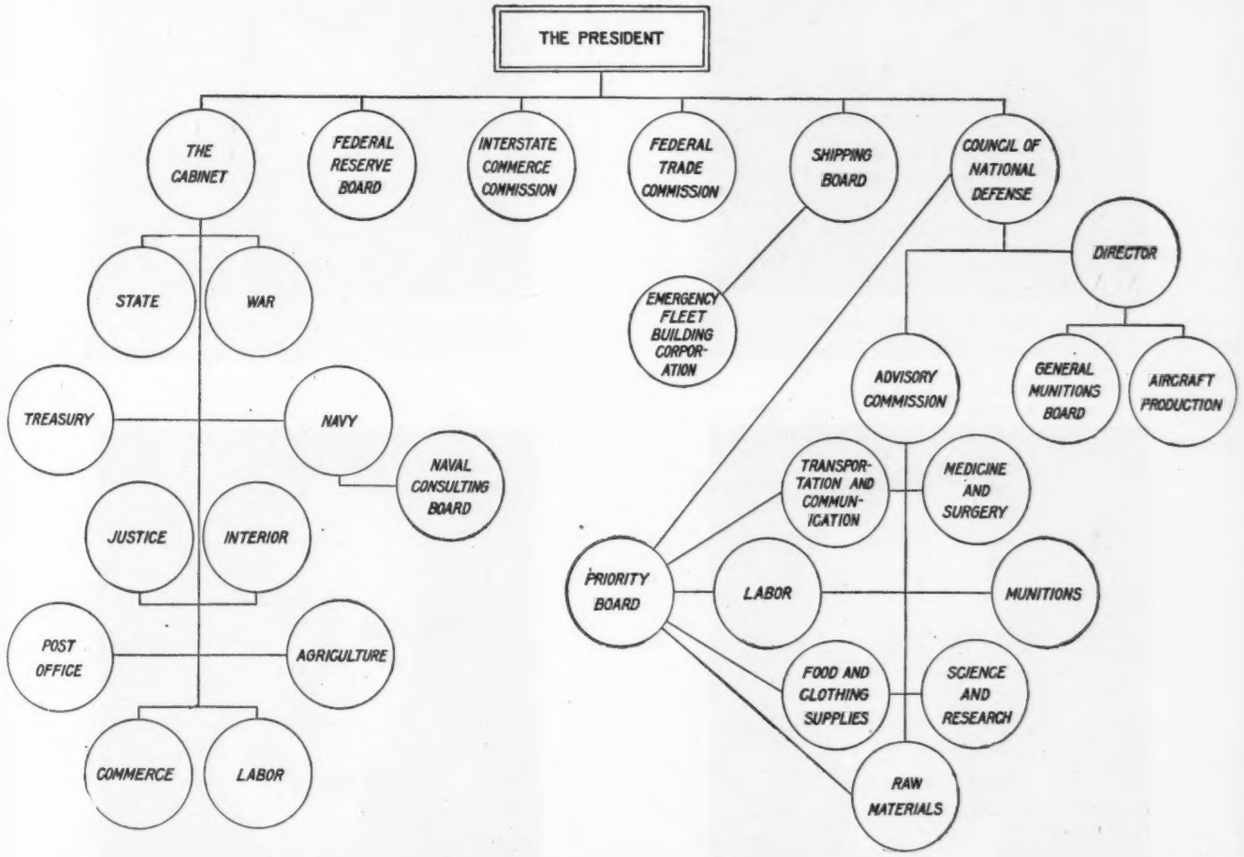
SYNOPSIS—Organization of various boards to supplement the regular Government bureaus in handling the tremendous work of preparing the country for war was necessary. A priority board to prevent much duplication and confusion will probably be added to coördinate the work of the various boards along lines shown by English experience to be most advisable.

President Wilson called it a war to make the world safe for democracy. Secretary of the Interior Lane, the other day, called it a test of the ability of this particular democracy, the United States, to organize itself out of and away from the dangers of economic anarchy.

The willingness to serve is abundant. Offers of ideas, offers of work, offers of material are flooding the National Capital. But the machinery for using it all in the way that will do the most good has not yet been perfected. It is a slow process. The indispensable thing is an agency for coördination, and that seems to be lacking.

Here is a case in point: Practically all the available steel of the country was offered to the Navy Department and accepted for the construction of big warships that are needed, but which cannot be finished for several years. This meant the diverting of steel from other industries, notably the building of railroad rolling stock and of merchant ships, to replace U-boat ravages, a diversion of material which has seriously handicapped the country in its work of feeding the Allies and making its own internal preparations for war. The steel should not have been turned over to the Navy Department but placed at the disposal of the Government to be parceled out in a more immediately effective way. And so with all classes of material and effort.

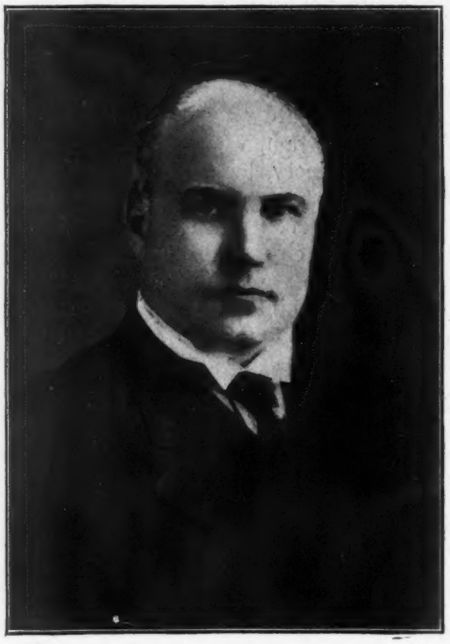
The accompanying chart from the New York *Times* indicates the present organization of the Government for war with one board or commission, called "Priority Board" in the diagram, which is not yet in the actual Government machinery, but which is very much needed there, according to Secretary Lane, who is one of the six Cabinet members constituting the Council of National Defense. Congress created this council. The President appointed the members of the Advisory Commission and then the council appointed the various committees making up the personnel of the seven main subdivisions of the commission. The Shipping Board, created by Congress last September, the Federal Trade Commission, the Federal Reserve Board, and the Interstate Commerce Commission, all have big war functions but are operating independently.



ORGANIZATION CHART, SHOWING RELATION AND COÖRDINATION OF GOVERNMENT WAR BOARDS

"It is a good organization," said Mr. Lane, "but we must have more complete coördination. England was finally obliged to establish its Priority Commission, the

Secretary Lane and Three of the Seven Members of the Advisory Commission of the Council of National Defense



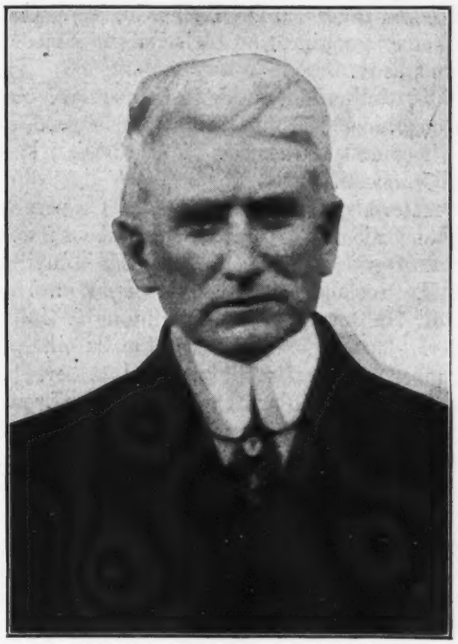
FRANKLIN K. LANE
Secretary of the Interior

BERNARD BARUCH

DANIEL WILLARD
President, Baltimore & Ohio R.R.

HOWARD E. COFFIN
Vice President, Hudson Motor Car Co.

The Four Other Members of the Advisory Commission of the Council of National Defense



DR. FRANKLIN MARTIN
A distinguished surgeon of Chicago

JULIUS ROSENWALD
President, Sears, Roebuck & Co.

SAMUEL GOMPERS
President, American Federation of Labor

DR. HOLLIS GODFREY
President, Drexel Institute

name of which is self-explanatory, and we need a board with the same powers in this country. Such a commission is in touch with the needs of every department of government and of every essential industry. It administrates no activity of its own, but sees to it that no activity is crippled because of lack of supplies and labor due to such supplies or because of labor being wasted or used to lesser advantage by being deflected to where the need is not so great. It determines the distribution of ships, of railroad iron, of steel plates, of ammunition and machinery. It hears the arguments of the various departments with apparently conflicting demands and then decides each case in such a way as to serve the greatest good of the whole country and the greatest efficiency. It may be true that such a priority board cannot appreciate the needs of a given activity as well as the technical experts in that activity, but such a board can know the needs of all better than any special group can know them. It can coördinate. It is like the case of the thousand persons all striving to get through a narrow doorway at the same time. Only a few get through. The rest get hurt. Somebody must line them up and they will all get through in good order and in reasonably good time.

"Group organization here is progressing rapidly, but the groups themselves must be tied into a whole machine abundantly lubricated with the oil of coördination. For example, the railroads organized for the war under a committee of the ablest railroad executives, who have interlocked the 250,000 miles of the country's railroads into a single coöperative system to eliminate wasteful competition and put the transportation of commodities and troops on the most effective war basis. But that does not go far enough. Beyond all that arises the question, what shall be shipped first, and in what quantities? The answer to that question should come from a Priority Board which knows what the most urgent need is at any given moment in any part of the world.

"Of course," said Secretary Lane, "we are just beginning in the United States on this work of broad-gage organization and coöperation. The war has waked us up to the necessity of it. It has shown beyond all question that a democracy cannot rest on economic anarchy."

Advisory Commission to the Council of National Defense

WASHINGTON CORRESPONDENCE

Owing to the rapidity with which events have been moving during recent weeks, it is evident that considerable confusion exists as to the details of the organization of the Council of National Defense. The Council was authorized in the national defense act, which became a law Aug. 29. At its head are the Secretaries of War, Navy, Interior, Agriculture, Commerce and Labor. To serve with the secretaries is an advisory commission which serves without pay. Directly under the cabinet officers is a paid director and an administrative organization, which includes the secretary of the council and four assistants to the director, with their respective assistants. Immediately under the director, but not connected with the advisory commission, are the sections and boards of the council, of which the food board, under the direction of Herbert C. Hoover, and the committee on coal production, under the direction of F. S. Peabody, are examples.

The mining industry is interested in most of the subdivisions of the advisory commission, comprising as they do some of the most prominent mining men. The committees and coöperative committees are as follows:

Transportation and communication, Daniel Willard. Coöperative committees on; telegraphs and telephones, T. N. Vail; railroads, Fairfax Harrison; electric railroads, Gen. George H. Harries.

Munitions, Howard E. Coffin. Coöperative committees on; national industrial conference, L. A. Osborne; public utilities, John W. Lied; industrial inventory, H. M. Lakeman; motor transport (unnamed).

Science and Research, Dr. Hollis Godfrey. Coöperative committees on; engineering societies (unnamed); education (unnamed).

Supplies, Julius Rosenwald. Coöperative committees on; cotton goods, Lincoln Grant; woolen goods, John P. Wood; shoes and leather, J. F. McElwain; knit goods, Lincoln Cromwell.

Raw materials, Bernard Baruch. Coöperative committees on; alcohol, Horatio S. Reubens; aluminum, Arthur V. Davis; asbestos, Thomas F. Manville; brass, Charles F. Brooker; coal tar products, Wm. H. Childs; lumber, R. H. Downman; lead, Clinton H. Crane; mica, L. W. Kingsley; nickel, Ambrose Monell; oil, A. C. Bedford; rubber, H. S. Hotchkiss; steel, Elbert H. Gary; sulphur, Henry Whiton; wool, Jacob F. Brown; zinc, Edgar Palmer; copper, John D. Ryan.

Labor, Samuel Gompers. Coöperative committees on; wages and hours, F. Morrison; mediation and conciliation, V. Everit Macy; welfare work, L. A. Coolidge; women in industry, Mrs. Borden Harriman; information and statistics, F. L. Hoffman; press, Grant Hamilton; publicity, Dr. Edward T. Devine; cost of living, S. T. Ballard.

Medicine and surgery, Dr. Franklin H. Martin. Cooperative committees on; general medical board and standardization, Dr. Franklin H. Martin.

The coöperative committees, which are of most interest to the mining industry, are composed as follows:

Zinc—Edgar Palmer, New Jersey Zinc Co., 55 Wall St., New York; Charles W. Baker, president American Zinc, Lead and Smelting Co., 120 Broadway, New York; A. P. Cobb, vice president New Jersey Zinc Co., 55 Wall St., New York; Sidney J. Jennings, vice president United States Smelting, Refining and Mining Co., 120 Broadway, New York; Cornelius F. Kelly, vice president Anaconda Copper Co., 42 Broadway, New York; N. Bruce MacKelvie, president Butte & Superior Copper Co., 25 Broad St., New York; Thomas F. Noon, president Illinois Zinc Co., Peru, Ill.; Chas. E. Orr, president Bertha A. Mining Co., Webb City, Mo.

Lead—Clinton H. Crane, president St. Joseph Lead Co., 61 Broadway, New York; Fred W. Bradley, president Bunker Hill & Sullivan Mining and Concentrating Co., San Francisco; Edward Brush, vice president American Smelting and Refining Co., 120 Broadway, New York; E. J. Cornish, vice president National Lead Co., 111 Broadway, New York; Harry L. Day, Hercules Mining Co., Burke, Idaho; F. Y. Robertson, vice president and general manager U. S. Metals Refining Co., 120 Broadway, New York.

Aluminum—Arthur V. Davis, president Aluminum Co. of America, Pittsburgh; E. E. Allyne, president Aluminum Castings Co., Cleveland; Jos. A. Janney, Jr., Morris Bldg., Philadelphia.

Receivership for Granville Mining Co.

On Apr. 24 Edward Dexter was appointed receiver for the Granville Mining Co. by the British court, chancery division, London, on a motion of the Gold Fields American Development Co. The action was, to a great extent, the outcome of intercorporate difficulties and was opposed by A. N. C. Treadgold, a director of the Granville company and himself a holder of some of its "prior-lien" and "first-mortgage" debenture stock, secured by trust deeds, to protect which the present action was brought by Gold Fields American Development Co. The Granville Mining Co. is a holding company, controlling important gold placers in the Klondike section of Yukon Territory. The exploitation of these areas by subsidiary companies was made possible by the Granville Mining Co., which raised the funds from various mining and development organizations, prominent among which was the Gold Fields American Development Co. Not much has been given to the public regarding the resources of the Granville company nor of the operation of its subsidiaries, but it has been known for many months that the company was behind in meeting its obligations. The receivership was asked, it appears, to protect the secured creditors from possible actions by unsecured local creditors of the Canadian Klondyke Mining and Power companies, and to prevent the forfeiture of the North-West Corporation's claims.

Some interesting details of the Granville history leading up to the present situation were given to the court by Mr. Maugham, K. C., who represented the plaintiff company in the receivership action. He told the court that the Granville Mining Co. was incorporated on Aug. 11, 1911, with a capital of £1,410,000 in £1 shares. Subsequently, there were issued £110,000 prior-lien debenture stock and £900,000 first-mortgage debenture stock; the former matures in 1923 and the latter in 1936. The Granville company turned over its alluvial properties and other interests to subsidiaries and now hold only the securities of other companies, principally those of the Canadian Klondyke Mining Co., of the Canadian Klondyke Power Co. and of the North-West Corporation, which in its turn held a controlling interest in a number of subsidiary Canadian mining companies. The difficulty that had arisen was this: Under the trust deed to secure the pior-lien debenture stock, dated June 25, 1915, there should have been deposited with the trustees some valuable bonds and securities belonging to the Canadian companies, but the defendant company had failed to make the deposit. It was also in default in the payment of interest, but that was not a matter upon which this application was based.

Deadlock Due To Disagreement In the Board

Mr. Maugham said the reason for the present deadlock was due to the fact that the board of the defendant company could not agree on the steps to be taken and that the companies in which they held the bonds and shares were in a serious condition. One, the North-West Corporation, Ltd., in which the company held a million shares, had a large number of claims, which, in accordance with the Canadian laws, had to be worked or forfeited. It had no cash and could not go on. The Canadian Klondyke Mining Co., and the Canadian Klondyke Power Co., associated with it, had not complied with the obligation to hand over the bonds to the Granville company; the companies were in the unfortunate position of owing large sums of money to unsecured creditors, who had the right, unless a receiver were appointed, to seize the assets, so that there was no protection for the holders of the prior-lien debenture stock. The present was the first step for putting the machinery in motion to obtain that protection, and when this receiver was appointed application would be made for authority to collect the bonds. The plaintiff company, being in effect the owners of the holding company and these assets, had to prevent the assets of the Canadian Klondyke Mining and the Power companies being seized by unsecured creditors; and to prevent the claims of the North-West Corporation being forfeited and to provide funds to keep them working until there was some kind of reorganization.

Chile Copper Co.'s Ore Reserves

Prior to the recent meeting of Chile Copper Co. stockholders to approve the increase in capital stock and the bond issue, President Daniel Guggenheim sent to stockholders a statement commenting on the extraordinary increase in ore reserves at the company's property at Chuquicamata. In April, 1913, the reserves were estimated at 95,657,000 tons of 2.41% ore, whereas the present "proven ore" is given as 354,700,000 tons containing 2.18% copper, with additional "probable ore" of 346,000,000 tons. President Guggenheim quotes from Consulting Engineer Fred Hellmann's letter of Dec. 28, 1916, as follows:

In response to your request, I have made a careful estimate of the ore reserves of Chuquicamata and find that the total ore in sight, that is, within the bore hole net, and without allowing for any extension of the ore whatsoever, either laterally or in depth beyond the bore holes, amounts to 354,700,000 tons of a value of 2.18%. This is distributed as follows:

	Tons	Copper Content
Oxidized ore	232,900,000	1.89%
Mixed ore	73,100,000	2.98%
Sulphide ore	48,700,000	2.36%
Total	354,700,000	2.18%

I have also made a forecast of "probable ore," which is not by any means a forecast of all the ore that will eventually be developed, but is an estimate, within reasonable limits, of what may assuredly be expected. To determine this quantity, I made cross sections at intervals of 400 ft. and placed on each cross section all available data derived from bore holes and other workings. I also made a longitudinal section, which assumed the thickness of the ore indicated by the bore holes in the center of the deposit and sloped the bottom of the ore upwards towards the north and south ends in conformity with the bore-hole results in both directions and allowing only moderate extensions of these bore holes where the same had stopped in ore. I then assumed these cross sections to extend only 100 ft. to the west of the most westerly north and south lines of bore holes, and on the east side I cut out all very low-grade ore and drew in the boundary lines of the ore deposit towards the west so as to exclude all low-grade ore on that side. I then caused these cross-sections to be divided into different classes of ore, as indicated by the bore holes, and the amount of each class of ore was calculated from these areas. The totals of the different classes of ore duly weighted with their values, gave the final total of all ore and its value. In this manner I reached a total of 700,000,000 tons of ore of a tenor of 2.12% copper, divided as follows:

	Tons	Copper Content
Oxidized ore	339,000,000	1.91%
Mixed ore	151,000,000	2.98%
Sulphide ore	210,000,000	1.84%
Total	700,000,000	2.12%

The values given to the different kinds of ore are those which apply to the ore already in sight and which are, as you are aware, very conservative. The whole estimate is, in my opinion, very conservative and moderate and will undoubtedly be exceeded.

The proven ore represents a 64-year supply for the present 10,000-ton plant; it is therefore proposed to increase plant capacity to 27,000 tons per day. Of the "probable ore," there would be a 34-years' supply of oxidized ore, alone, for the enlarged plant and at the end of this period, there would still remain 361,000,000 tons to be treated. Treating 27,000 tons of oxidized ore of 1.91% copper tenor, President Guggenheim stated that an extraction of 88% can be obtained and 300,000,000 lb. of refined copper can be delivered annually either in Europe or the United States for 6c. a pound.

Since the Chuquicamata plant began partial operation on May 18, 1915, production and total costs of delivered copper have been as follows: In 1915 (7½ months) 10,944,824 lb. at total cost of 18.55c. per lb.; 1916 (12 months) 41,305,476 lb. at cost of 15.65c.; 1917 (2 months) 13,812,000 lb. at 13.24c. per lb. delivered. The cost at Chuquicamata was 9.64c. per lb. for this January and February production. Transportation and insurance costs are approximately 2c. per lb. more than before the war.

Because of the immense ore deposit, President Guggenheim stated that the directors have in mind ultimately increasing the capacity of the reduction plant to 50,000 or 60,000 tons per day

Separation of Nickel and Cobalt by Red Lead

A method of separation of nickel and cobalt, using Pb_3O_4 as the means of removing iron from the solution, is given by T. L. Walker (*Trans.* Royal Soc. Can., p. 93, 1915).

To the hot solution containing iron, nickel, cobalt, copper and lead as chlorides add a few drops of hydrogen peroxide to oxidize the iron, nearly neutralize with Na_2CO_3 and then gradually add Pb_3O_4 while boiling in a flask. It is necessary to agitate the flask continuously. There is evolution of Cl and precipitation of PbO_2 and Fe $(OH)_3$. Add Pb_3O_4 to excess as shown by the distinct red color of the heavy precipitate. Filter and wash with H_2O. From the filtrate precipitate the lead and other metals of that group by H_2S, after which concentrate the solution to 100 c.c. Finally add 3 c.c. concentrated H_2SO_4, 30 c.c. NH_4OH (sp.gr. 0.88) and deposit the nickel and cobalt by electrolysis, using a revolving gauze cathode with a current of 5 amp. at 5 volts. Deposition is complete in 30 min. Figures show the separation of iron from nickel by this method to be complete, but in separation of cobalt and iron there may be a loss of 10% of the cobalt. Slightly better results were given for the latter by using PbO_2. In the electrolysis of solutions of $CoCl_2$ and $NiCl_2$ there is no interference from the Cl under the conditions described. To a solution of $CoCl_2$ was added 3 c.c. H_2SO_4, 30 c.c. NH_4OH and water to make 150 c.c. To a like amount of $CoCl_2$ were added 3 c.c. H_2SO_4 and the solution heated until SO_3 fumes came off. The residue was made ammoniacal as in the previous case and diluted to 150 c.c. Upon electrolyzing both of these, using rotating gauze cathode and 4 amp. at 5 volts, deposition of Co was complete in 20 and 30 min., respectively, and the amounts were identical. These and other experiments indicate that the chlorides of cobalt and nickel may be employed for electrolytic determinations, provided that the same amount of sulphates be present as would be required for the satisfactory plating out of cobalt from the sulphate. If the dimethylglyoxime method be employed for precipitation of nickel in presence of iron, it is necessary to add tartaric acid, to keep the iron in solution. The accuracy of this method is about the same as that of the Pb_3O_4 method, provided the solution stands about 24 hours.

Foreign Trade in Copper

Exports of copper from the United States in March, 1917, are reported by the Department of Commerce as follows:

	March Lb.	Total for Jan.-Feb.-Mar.
Ore and concentrates, contents	461,131	1,523,211
Unrefined, in bars, pigs, etc	.....	2,520,039
Refined, bars, etc	102,814,125	280,070,015
Old and scrap	402,752	446,416
Plates and sheets	8,074,657	11,408,640
Wire	3,442,580	7,528,817
Total	115,195,245	303,497,138

The weight of ore exported in March was 4432 tons; of concentrates, 594 tons.

Imports of copper into the United States in March, 1917, are reported by the Department of Commerce as follows:

	March Lb.	Total for Jan.-Feb.-Mar.
Ore and concentrate contents	10,732,049	36,896,126
Matte and regulus	218,957	752,999
Unrefined, in bars, pigs, etc	31,799,828	99,131,781
Refined, in bars, etc	239,291	2,964,667
Old, etc., for manufacture	1,691,056	5,474,592
Composition metal, copper chief value	47,679	112,364
Total	44,728,860	145,332,529

Material imported in March was 24,341 tons ore, 13,188 tons concentrates and 258 tons matte and regulus.

Mineral Output of Italy in 1915

According to official reports in *Revista del Servizio Minerario nel 1915,* the principal items of mineral production in Italy in 1915 were as follows, arranged in order of descending value: Sulphur, crude, 2,222,399 metric tons; lignite, 939,027; iron ore, 679,970; silver-lead ore, 41,590; zinc ore, 80,622; iron pyrites, 327,707; mercury ore, 110,642; copper ore, 74,470; petroleum, 6,105; boric acid, 2,497; copper pyrites, 41,613; asphaltic and bituminous rock, 47,650; antimony ore, 4,334; rock salt, 33,267; salt, 17,914; manganese ore, 12,577 metric tons; natural gas, 5,812,000 cu.m.; bituminous coal, 6,954 metric tons; mineral waters, 26,800; graphite, 6,176; bituminous schist, 4,741; alum, 4,850; bauxite 5,900; gold ore, 296; lead and zinc ore, 250 metric tons.

The principal metals produced, exclusive of iron and steel were: Lead, 21,812 metric tons; mercury, 985; aluminum, 904; copper, 940 metric tons; silver, 14,759 kg.; antimony, regulus and sulphide, 548 metric tons. The number of working mines was 619, of which 316 were sulphur producers.

Alaska Gold Mines Co.

The report of the Alaska Gold Mines Co. for the first quarter of 1917 shows that 541,093 tons, averaging $1.207 per ton, was milled, yielding $0.997 per ton, an extraction of 81.06%. Operating expenses amounted to $0.788 per ton, leaving a profit of $0.209 per ton.

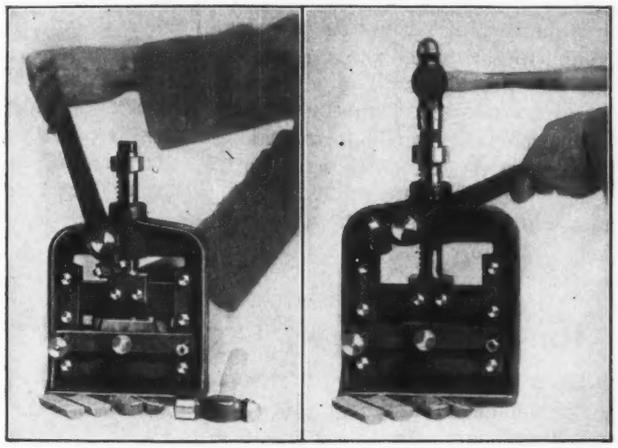
The value of bullion and concentrates produced was $539,488; total expenses were $430,748, leaving an operating profit of $108,740.

Details of Practical Mining

Splitting Diamond-Drill Cores

A drill core is one of the best exploratory records that can be had, for the reason that it shows in relative position the various formations that have been passed through by the diamond drill. The drill core gives a geologic history and its careful preservation is therefore a matter of great moment, especially when the cost of securing the core may have been from $3 to $5 a foot. In drilling through mineralized zones it is important to know the mineral content of the core; still one is reluctant to grind the core to pulp, for the reason that its usefulness as a geologic record is thereby destroyed. It is obvious that if the core can be split longitudinally, one-half will serve as a complete geologic record and the other, if ground, will furnish a sample of the rock that has been drilled.

The geological and mechanical departments of the E. J. Longyear Co., of Minneapolis, Minn., have developed a machine for the purpose of splitting diamond-drill cores.



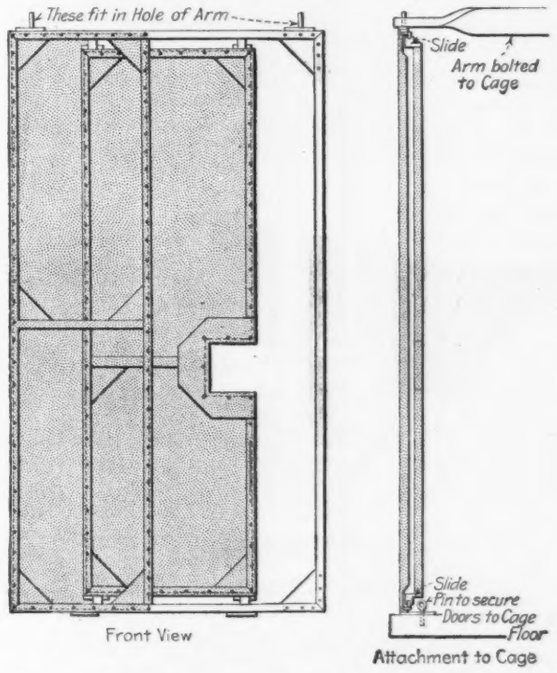
CORE-SPLITTING DEVICE

The core splitter has been tested out thoroughly, and a number of them are now in use by this company in its various diamond-drilling operations. With care even the most schistose rocks may be split accurately.

The construction of the machine will be readily understood from the accompanying illustrations. It consists essentially of a stationary and a movable knife-blade set in an iron frame. The stationary blade is clamped between guides, and the movable one is attached in such a manner that by means of a rack and pinion the upward and downward motion of the blade may be controlled by a hand lever. One of the illustrations shows the core being placed in position; the other, the core in place between the blades ready for splitting, which is accomplished by striking the top of the ram a sharp blow. This will split the core longitudinally (split cores are shown in front of the machine). The side bars are then pulled out to allow the halves to drop. Four springs hold these side bars in position against the frame. An adjustment is provided to accomodate cores of different diameters. The adjustment is so aranged that the two side bars (one on each side) move toward or away from the plane of the blades simultaneously. This is essential in order to have cores of different diameters held in position between the knife-blades so that they will be divided into "equal halves." The device is a useful addition to any diamond-drilling equipment.

Safety Door for Mine Cage

C. M. Leonard, master mechanic, and Joe Dickey, blacksmith, of the Vindicator Consolidated Gold Mining Co., of Cripple Creek, Colo., have devised a safety door for mine cages, which, Fred Carrol, Commissioner of



SAFETY DOOR FOR MINE CAGE, SHOWING CONSTRUCTION AND MANNER OF ATTACHING

Mines, is recommending for general use in the state. As shown in the illustration, the construction is very simple, the door being removed from the cage by simply pulling out the two pins that fit into the cage floor, which allows it to be removed for the hoisting of ore.

Clear Line Blueprints

Blueprints with very clear white lines on an exceptionally blue background may be made as follows: After the print has been exposed for the required length of time, it should be left in the frame, or "over-exposed," for about 30 sec. (bright sunlight) longer and then quickly washed with clean water. Then apply with a brush or by pouring directly on the print, a solution made

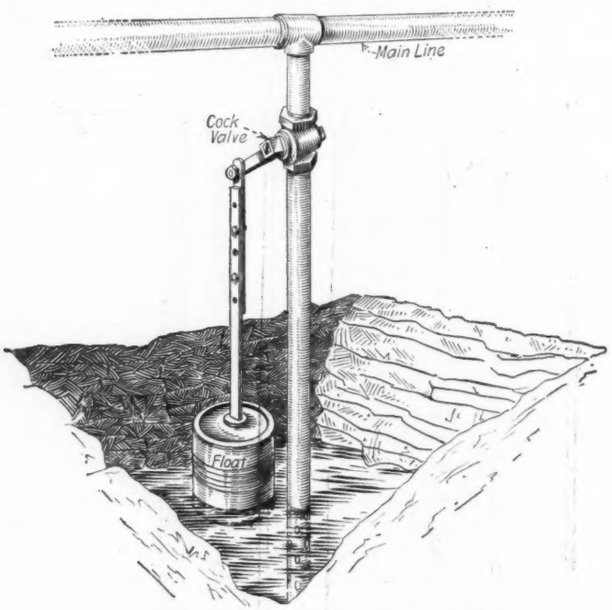
by dissolving about 4 oz. of commercial potassium bichromate crystals in 1 gal. of water, and let stand until the white lines on the print are perfectly clear; usually about 30 sec.; then wash in clear water as before.

With a little practice excellent prints may be made, with the advantage of all the prints being of the same shade, this being especially desirable when several prints are bound together in pamphlet form.

An Automatic Suction Control

At some mines where several pumps are required, each drawing water from several sumps, unless some kind of automatic suction-control device is employed more than one pumpman will be necessary to keep all the pumps in efficient operation.

The accompanying illustration from *Coal Age* shows a device useful for governing the flow of water from the various sumps to a single pump. It consists essentially



THE SUCTION CONTROL IN A SUMP

of a cock in the sump suction line, a float in the sump and a suitable rod and lever connecting the two. When the water in the sump rises, the float opens the cock; when it falls, it closes it.

For a float an old powder can is used. The hole, of course, is first effectually sealed after which the can is given a good coat of paint. This answers the purpose fairly satisfactorily. By means of the above-described apparatus several sumps may be kept pumped out without the continuous care of the pumpman.

Fire Protection in Shafts

Shaft fires are the most dangerous kind as they may paralyze the ventilation and hoisting arrangements and jeopardize the lives of those underground. To afford protection from fire the following system was devised by Christopher T. Roberts and described in United States Patent No. 925,230.

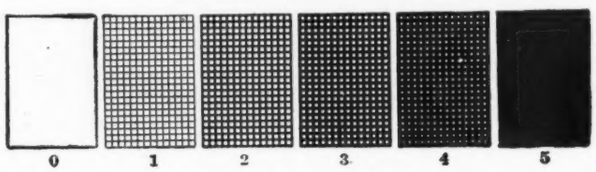
A tank of large capacity is placed on the surface near the mouth of the shaft. Leading from the bottom of this tank is a large header which goes down the shaft into the sump. Connected to this at intervals are smaller-sized sprinkler pipes which are placed horizontally under the wall plates. A valve is placed in the main header where it leaves the tank. The bottom of the header is provided with a bypass-valve system to the return pipe leading from the sump up to the tank. A pump is connected to this upcast pipe. The valve arrangements permit the pump to either throw the sump water up the upcast to the tank or, in case of fire in the lower part of the shaft, to force the water up into the main header and horizontal sprinklers. In this event the main header valve at the top is closed. If the fire is in the top of the shaft, the pump throws water from the sump into the tank and the main header valve at the top is opened so that the water flows from the tank down through the header and horizontal sprinklers. A 2 x 4 or 2 x 6 should be spiked to the top of each wall plate to make a trough to hold the water and tend to make it run down the lining of the shaft from the sprays above.

This system differs from the regular sprinkler system in that there is no water in the pipes except in the event of fire and the system is not automatically controlled, but is always under control from the surface.

[In "Rules and Regulations for Metal Mines," published as Bulletin 75 of the Bureau of Mines by the committee consisting of W. R. Ingalls, James Douglas, J. R. Finley, J. Parke Channing, and John Hays Hammond, this question of sprinkling to safeguard against underground fires at mines was considered at quite some length, and the report says "The committee also finds that the actual use of such sprinkling systems in shafts is under the suspicion of causing reversal air currents with resulting loss of life. Although such reversal has not been actually proved, there is indeed the possibility that such may happen, and that there may be fatal results therefrom."—Editor.]

Ringelmann Smoke Densities Chart

Much of the difficulty of describing the density of smoke emanating from a stack is obviated by the use of the Ringelmann chart, a miniature of which is shown in the illustration. The chart, as shown, is made up of six rectangles, four of which consist of crossed lines so spaced and of such weight as to give a variation of 20% No. 2, corresponding to 20% black; No. 3, 40%; No. 4, 60%; No. 5, 80%; and No. 6, 100%. The chart is



RINGELMANN CHART

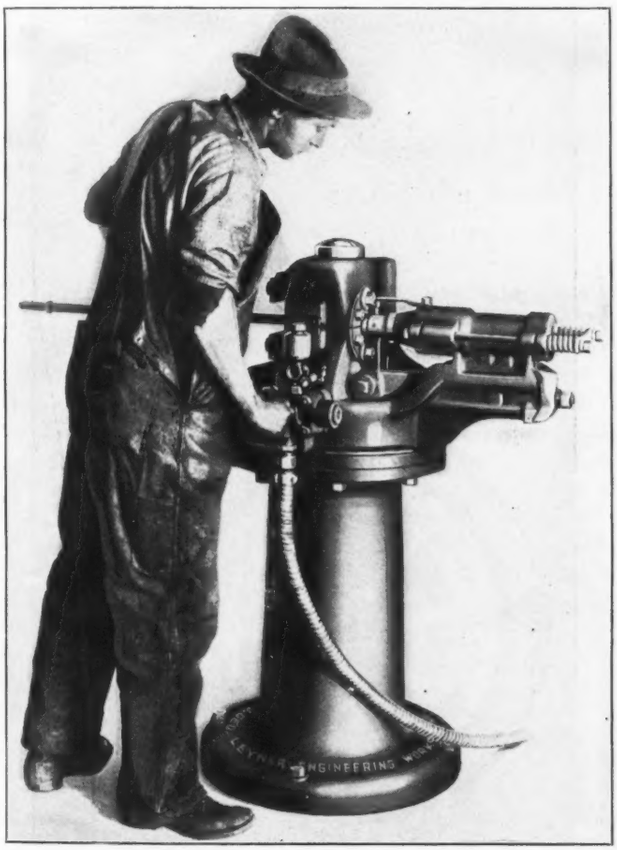
placed before the eye at such a distance that it loses the checkerboard appearance and the smoke observed directly at the top of the stack. A small amount of practice will enable one to determine the smoke density and in many of the cities in the United States which have accepted these gradations as standard, smoke of No. 3 density is considered to be a nuisance.

Mining and Metallurgical Machinery

Sharpener for Small-Sized Drill Steel

The superiority of machine-sharpened drill steel has been thoroughly demonstrated, but the cost of a drill sharpener has been too great for small plants. To fill this need the Ingersoll-Rand Co., has introduced a small-sized drill-sharpening machine for handling the steel for the smaller size of hammer and piston drills and within the reach of the users of two or three drills. This is known as the Leyner Jacksteel Sharpener, a small "edition" with modifications, of the standard No. 5 Leyner Sharpener.

The new machine is designed to handle small sizes of steel such as 1⅛ in. maximum diameter round, cruciform,



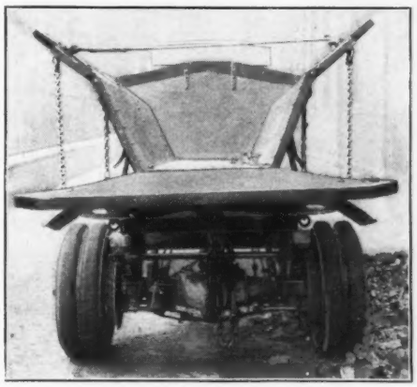
SMALL DRILL SHARPENER FOR JACKHAMER STEEL

and light section, twisted or banded steel; 1 in. maximum diameter hexagon or octagon steel; ⅞ in. maximum square steel. Bit sizes, 2 in. maximum diameter 4, 5, 6 point, Z, X and single- or double-chisel bits of standard 14-deg. taper; 1¾ in. maximum diameter "Carr" or bits of other than 14 deg. taper. Shanks can also be made on the smaller sizes of steel by the usual Leyner method.

As the illustration shows, the Leyner Jacksteel Sharpener is of simplified design and extremely compact. Its weight, 925 lb., permits ready transportation.

The Lee Motor-Truck Body

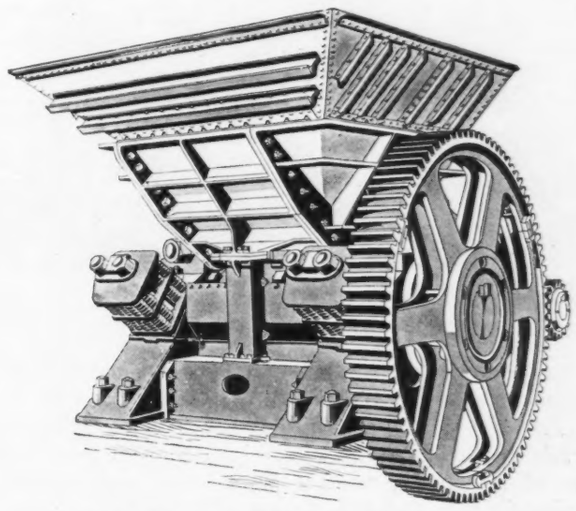
Flexibility of equipment is the present-day need which caused the Lee Loader and Body Co., 2343 South La Salle St., Chicago, to develop the general-purpose body for motor trucks shown in the illustration. This has a flat floor and an end gate, hinged at the top or bottom as desired. A truck equipped with such a body, either of the two-way or three-way type, can be used equally well for hauling loose materials such as coal, ore, sand, crushed stone, etc., and lumber, barrels, or, in fact, practically any kind of supplies that have to be transported over the road on the return trip. This new type of body is built in all sizes from one to six or more yards' capacity, and is made to fit any type of truck chassis trailer or wagon gear.



LEE MOTOR-TRUCK BODY

Huge Single-Roll Crusher

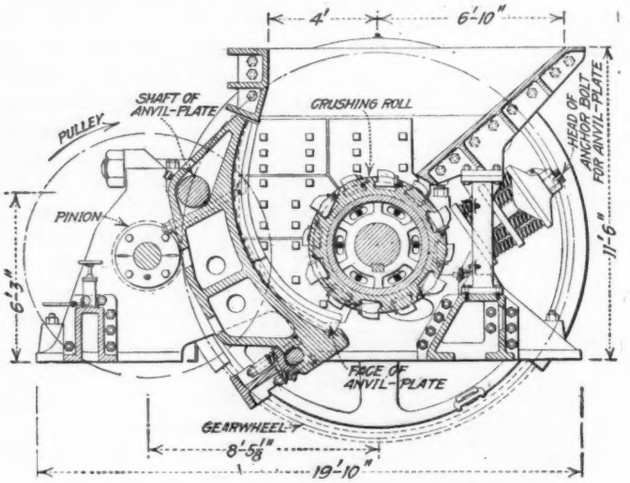
A single-roll crusher of the Fairmount type, weighing 225 tons, made by the Allis-Chalmers Manufacturing Co., has been installed at the limestone quarry of the Michigan



THE ALPENA ROLLER ROCK CRUSHER

Alkali Co., at Alpena, Mich. This installation is the largest of this type to date. The crushing roll is horizontal, as shown, and is provided with projecting teeth

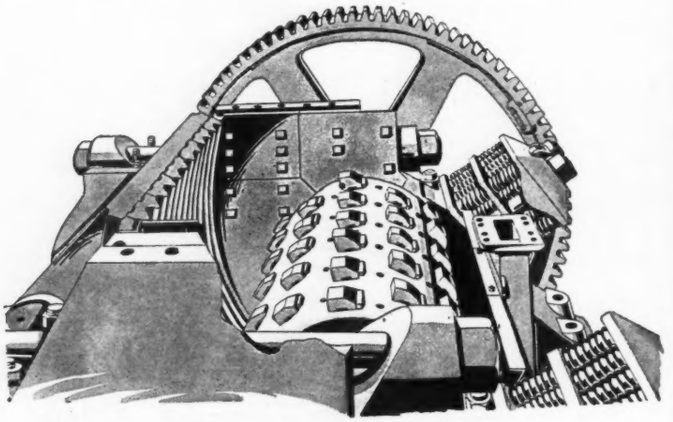
in staggered rows upon the face. The crushing is done against an anvil plate, built up in vertical sections. These sections are hollow steel castings, strung upon a shaft and having the lower or jaw ends carried by a cross-beam which is held by diagonal anchor bolts. Heavy springs on the ends of these bolts allow the jaw to give slightly under excessive pressure and so prevent breakage. The roll on the Alpena crusher has a cast-steel shell 7½ in. thick, with teeth of manganese steel keyed in slots. This shell is keyed upon a cast-iron spider, which in turn is keyed to a



SECTION OF ALPENA ROLLER CRUSHER

heat-treated steel shaft 20 in. diameter at the bearings. This is belted to a 250-hp. motor which runs at 580 r.p.m. The crushing roll runs at 23 r.p.m.

The main part of the hopper is of cast steel 7 x 12 ft. at the top. Above this is a structural-steel hopper into which the rock is dumped from standard-gage quarry cars. Rocks 5 x 7 ft. can be handled. The crusher is



SECTIONAL VIEW OF CRUSHER, SHOWING ROLL WITH KNOBS AND STUDS

adjusted for a 7-in. product and delivers about 7000 tons of broken stone per 10-hour shift.

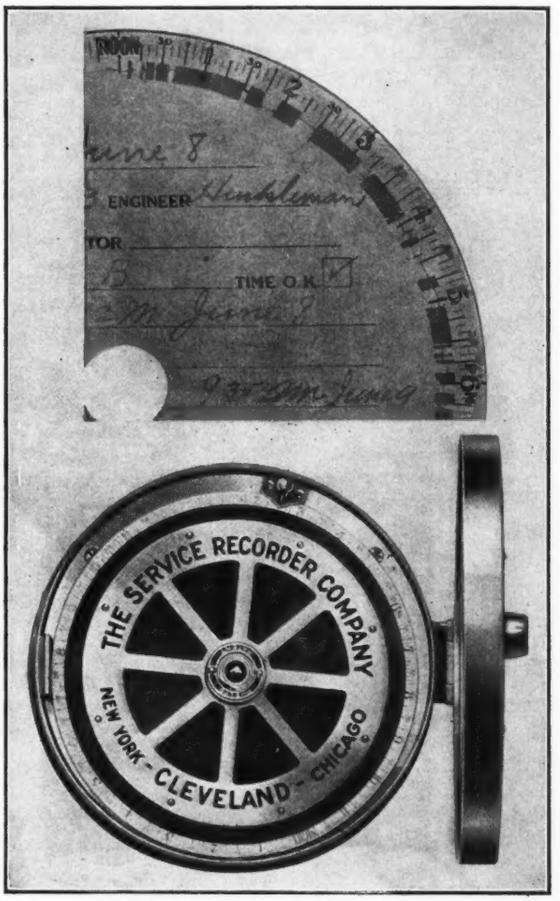
The two principal points in which the Fairmount crusher differs from earlier roll-type crushers are (1) the use of an anvil gradually approaching and extending under the roll, and (2) the use of a roll having part of the knobs or studs higher than the regular ones. The first feature increases the size of the opening where the stone is crushed against the anvil plate. In regard to the large or slugger knobs, it has been found that with knobs of uniform height the crusher is not suitable for breaking large stone.

The first crushers of this type were installed in 1911 at the plant of the Casparis Stone Co., at Fairmount, Ill., where two of the machines were started in 1912.

This machine was designed under the direction of R. C. Newhouse, engineer of the crushing and cement machinery department of the Allis-Chalmers company.

Recorder for Shovels or Dredges

The Service Recorder Co. of 2345 East 105th St., Cleveland, Ohio, has placed upon the market an instrument for recording the running and standing time of locomotives, motor trucks, steam shovels and dredges. This instrument, called a Servis Recorder, is of extremely simple construction, is entirely self-contained, and can be attached in a few minutes to any of the running parts of a machine. To record operation it uses the oscillation or sway of the equipment through the medium of a pendu-



SERVIS RECORDER AND SECTION OF CHART

lum, which is so constructed as to avoid the recording of vibrations or jars. The instrument is inclosed in a steel case unauthorized opening of which is safeguarded against by a plunger which cuts the recording chart when the lid is opened or removed. An eight-day clock controls the timing mechanism. The data which may be obtained through the registration of actual time consumed in operations over the registration of the number of operations, as registered by a counter, can readily be appreciated.

Events and Economics of the War

The French and British commissions have been making a tour of the country and have now returned to Washington for final consultations previous to their departure for home.

Congress has been talking, without accomplishing much of anything and its inability to do business is getting on the nerves of people. Similarly is the chaos in the administrative departments in Washington. Out of the contest between the bureaucrats and the business men it is likely that we shall see the creation of some new departments of do things with men like Hoover, Coffin, Goethals and Willard at the head of them. In the meanwhile more preparations for equipping the new army are being made probably than is appreciated.

The assistance of bankers has been invoked to help float the Liberty Loan.

Nothing of great importance has transpired on any of the fronts. The great center of interest has been in Russia, where the new spirit of liberty has flamed too recklessly. The dominance of the socialists is disquieting, but it is hoped that common sense will prevail and already the socialist leaders seem to have awakened to the danger to the nation in their course.

Hoover To His Associates on the Belgian Commission

To my associates of the Commission for Relief in Belgium: We are sure that the whole American people will be glad to know that through the sympathetic arrangements made by the President and the Secretary of Treasury, the cost of the Belgian and Northern France relief, so far as it is feasible under present shipping conditions, will be borne for the next six months by the American Government. This has been made possible by a loan of $75,000,000 from the United States to the Governments of Belgium and France. The money will be advanced by the Treasury in installments of $12,500,000 per month, of which $7,500,000 will be available for Belgian relief and $5,000,000 for the relief in Northern France. The way is open so that at the termination of the six months thus provided for, application may be made to the Government for further loans. We desire to state that although the Commission has endeavored for many months to secure this gratifying result, we feel that the appeals that have been made by you have largely influenced the Government in finally granting the request of the Belgian and French Governments. Therefore the time, energy and money expended in your campaign have done more than to bring in immediate contributions; they have helped to insure the relief of Belgium and Northern France throughout the war.

The Commission has long desired Government recognition in order that its work should be more firmly established as a distinctly American undertaking, and we feel that you will join with us in intense satisfaction that the work will now be shared by the whole American nation.

Realizing that each Committee and community has adopted its own method of making appeals and collecting funds, we do not purpose suggesting the specific action which you will take in meeting the changed conditions resulting from this gratifying action of our Government, but we outline below, in a few paragraphs, answers to certain general questions that may arise.

1. It will be noted that $12,500,000 per month is much less than the amount which we have stated as necessary to supply the imports required for the limited ration we have endeavored to provide. The explanation lies in that this amount will now cover all of the foodstuffs that we can hope to ship owing to the recent swiftly developed shortage of the world's shipping. Our statements in regard to the amount necessary have been correct and the balance between the $12,500,000 and the former estimate required to give the limited ration will now of necessity be supplied by encroaching upon the country's stock of milk cattle which had been reserved to maintain a supply of fresh milk for the children and to serve as a nucleus from which to re-stock the country after the war. The importation of meat, particularly fats, has always been one of the most expensive items in our program.

2. It must be clearly understood that the Commission for Relief in Belgium will continue to assume the entire charge of purchasing and transporting all food into Belgium and Northern France. The Commission also will continue to be the only fully regularized vehicle by which money, food and clothing can be sent into Belgium.

3. The Commercial Exchange Department will continue as heretofore to effect transfers of money into Belgium. By depositing dollars in our New York office or pounds sterling in London, the equivalent in francs will be paid to any person in Belgium provided the name and correct address be supplied. This service extends over practically all of Belgium except for a small restricted portion under military control. Individuals or committees outside of Belgium can send money to relatives or friends, or support by direct money contributions any of the specially deserving internal charities which use local currency to advantage in payment of wages or in purchasing homegrown products. Over $5,000,000 has been transferred in this way since the belligerent governments gave their official sanction to the operations of this department.

4. The Government payments will commence on June 1; and we shall be glad to have remittances up to that date, but we make no appeal for contributions thereafter.

5. We suggest that you offer to cancel all pledges made to you for future payments and offer to return any moneys which have been paid in advance on account of maturing pledges.

6. The children of Belgium will have the first call upon all food which is imported, and every effort will be made to maintain the supplementary meal which has been so important a factor up to the present in sustaining the health of millions of children.

7. Naturally, having built up such an effective organization you will desire to keep it alive as far as possible, and we venture to suggest that, although the general relief of the countries involved will now be met by the Government appropriations, emergencies and special conditions may arise which could only be met by private donations. In such circumstances your organization will afford a ready means of meeting the demands of the situation, whatever they may be. Should any of your contributors desire to continue their gifts, notwithstanding the present position, they may be assured that their contributions will be expended sooner or later to great advantage, since in any event relief in many forms will doubtless be required after the war.

8. Finally I wish for myself and my colleagues of the Administration of the Commission to express my sincere appreciation of all the untiring, faithful and truly beautiful work you have done as organizers and managers, and of the generous response which your long lists of donors have made. My association with you has been to me an inspiring revelation of the great heart of America.

To you as individuals and as organized groups I express my heartfelt thanks. HERBERT HOOVER,

Chairman Commission for Relief in Belgium.

The Existing Coal Emergency

The country at the present time in the matter of its fuel production is confronted with a great emergency according to a report by F. S. Peabody, chairman of the coal committee, Council of National Defense.

Notwithstanding the increased production of coal from practically every district, he says the increasing requirements to meet the needs of all classes of industry, as well as for the comfort and welfare of the people and the transportation of troops, munitions, food, and other products, together with the supplying of our allies, and for our national protection are liable to surpass the capacity of our mines unless the full coöperation of the mining, transporting, and distributing agents of this country is secured. This emergency requires not only the development of the highest efficiency, especially on account of a diminished supply of labor used in the production of coal, but also more comprehensive methods of coöperation by the coal producers with the transporting and distributing agencies, so that not only a full production will be secured, but also that this production shall find its way over our railroads into those centers where the most urgent need exists. If the demand for this product continues to increase it may be necessary for active steps to be taken to confine so far as possible the distribution and use of it to those activities which are more nearly vital to the welfare and protection of the nation. That this may not effect an unnecessary hardship upon the domestic welfare of our people it is necessary to promote the closest coöperation. An emergency exists, but it is the belief of this committee that with the assistance of the public in conserving supply, sufficient fuel can be had to meet public necessity.

We believe that the first essential toward an increased production of coal is a close coöperation between mine employer and mine employee, and inasmuch as the United Mine Workers of America and the mine operators in several districts have already pledged by joint resolutions to the Council of National Defense, under whom this committee works, and have nominated committees, the services of which have been offered to the Council of National Defense to this end, we now call upon the several committees to use their best and continued efforts to increase, in so far as they are able, the production of coal for the public necessities by keeping the mines continuously at work, avoiding labor disputes and unnecessary shutdowns. The operation of well-established mines should not be impeded and we suggest and urge that the practice of moving miners from the mines of well-established producing companies or communities to other districts be discouraged, as this practice creates a state of unrest and tends to decrease the total output of coal, interfering with the stability of the industry which is necessary for the highest efficiency. An effort should be made to instill in the mind of the individual miner and operator, as well as the organized body, the necessity of individual effort and continuous performance so far as work is offered. The miner or the company's representative who remains at work renders as patriotic service as the man at the front.

The Problem of Troop Moving

In order to give the public an idea of the enormous transportation problems that must be met in the moving of armies, the Special Committee on National Defense of the American Railway Association, of which Fairfax Harrison, president of the Southern Ry., is chairman, yesterday made public the following statement prepared by Lieut.-Col. Chauncey B. Baker, of the Quartermaster Corps, U. S. A.:

To move one field army of 80,000 men, consisting of three infantry divisions, one cavalry division and a brigade, technically known as a brigade of field army troops—troops auxiliary to the infantry and cavalry divisions—requires a total of 6229 cars made up into 366 trains with as many locomotives. The 6229 cars would be made up of 2115 passenger, 385 baggage, 1055 box, 1899 stock and 775 flat cars.

That quantity of equipment represents 0.7 of 1% of the locomotives owned by American railroads, 4.2% of their passenger cars, and 0.2 of 1% of their freight equipment.

The railroad equipment required to move various organizations of the army at war strength is as follows:

Infantry regiment, 55 officers, 1890 men, 177 animals, 22 vehicles; cars required, 48 passenger, 5 baggage, 15 box, 9 stock, 8 flat or gondola; total, 85 cars.

Cavalry regiment, 54 officers, 1284 men, 1436 animals, 26 vehicles; cars required, 36 passenger, 8 baggage, 25 box, 72 stock, 9 open; total, 150 cars.

Artillery regiment, light, 45 officers, 1170 men, 1157 animals, 32 vehicles, 24 guns; cars required, 32 passenger, 9 baggage, 25 box, 58 stock, 46 flat; total, 170 cars.

Artillery regiment, horse, 45 officers, 1173 men, 1571 animals, 35 vehicles, 24 guns; cars required, 34 passenger, 10 baggage, 25 box, 78 stock, 47 flat; total, 194 cars.

Artillery regiment, mountain, 45 officers, 1150 men, 1229 animals, 24 guns; cars required, 30 passenger, 7 baggage, 30 box, 61 stock; total, 124 cars.

Engineers, pioneer battalion, 16 officers, 502 men, 165 animals, 12 vehicles; cars required, 14 passenger, 2 baggage, 10 box, 8 stock, 4 flat; total, 38 cars.

Signal Corps, field battalion, 9 officers, 171 men, 206 animals, 15 vehicles; cars required, 6 passenger, 2 baggage, 5 box, 10 stock, 5 flat; total, 28 cars.

The Nissen Hut

To no other profession can the army owe more than to that of mining engineering, says the South African *Mining Journal*, both in the proportion of its members who have joined up and to the unique special knowledge and experience which it has contributed to the common fund. One of the now best-known new pieces of war equipment,

due to the fertile brains of mining men, is the Nissen hut, invented by Major P. N. Nissen, R. E., the originator of the "Nissen stamp," which has already been adopted on most of the world's gold mining fields. The Nissen hut is likely to have a wide scope of usefulness in new territories of exploration and industry after the war, so that the following account of it from the picturesque pen of Filson Young, which appeared in the *Daily Mail* of Feb. 6, is of much more than merely passing interest: "At about the same time as the tanks made their memorable début on the battlefield, another creature, almost equally primeval of aspect, began to appear in the conquered areas. No one ever saw it on the move or met it on the roads; it just appeared. Overnight you would see a blank space of ground; in the morning it would be occupied by an immense creature of the tortoise species, settled down solidly and permanently on the earth and emitting green smoke from a right-angle stem at one end, where its mouth might be, as though it were smoking a morning pipe. And when such a pioneer found that the situation was good and the land habitable it would apparently pass the word; for by twos and threes, by tens and hundreds, its fellow-monsters would appear, so that in a week or two you would find covered with them a valley that had been nothing but pulverized earth before. The name of this creature is the Nissen hut. It is the solution of one of the many problems that every war presents. The problem here was to devise a cheap, portable dwelling-place wherein men could live warm and dry; cheap enough to be purchasable by tens of thousands; portable enough to be carried on any road; big enough to house two dozen men; simple enough to be erected by anybody and on any ground; and weatherproof enough to give adequate protection from summer heat and winter cold."

Conservation of Platinum

Having in mind the present needs of American industries, educational institutions, and sciences for platinum, and the possible future requirements of the Government, the Jewelers' Vigilance Committee, after giving the subject careful thought, at the request of the Secretary of Commerce, has adopted the following resolutions which are set forth in *Commerce Reports:*

Whereas, The Secretary of Commerce has requested the platinum committee of the Jewelers' Vigilance Committee to bring to the attention of the jewelry trade of the United States the advisability of conserving platinum in order that our Government may have larger supplies to draw upon for war purposes, and

Whereas, The jewelry trade has already clearly expressed its desire and determination to assist our Government to the extent of its ability in bringing the war to a successful termination; be it

Resolved, That we pledge ourselves to discontinue and strongly recommend to all manufacturing and retail jewelers of the United States that they in a truly patriotic spirit discourage the manufacture, sale, and use of platinum in all bulky and heavy pieces of jewelry. Be it further

Resolved, That during the period of the war or until the present supplies of platinum shall be materially augmented, we pledge ourselves to discontinue and recommend that the jewelry trade discourage the use of all nonessential platinum findings or parts of jewelry, such as scarfpin stems, pin tongues, joints, catches, swivels, spring rings, ear backs, etc., where gold would satisfactorily serve. Be it further

Resolved, That the jewelry trade encourage by all means in their power the use of gold in combination with platinum wherever proper artistic results may be obtained. Be it further

Resolved, That copies of these resolutions be handed to the Secretary of Commerce, to the trade press, and be sent to all our trade organizations, and to the daily press, in order that they may have the widest possible dissemination.

In commenting upon these resolutions, Secretary Redfield made the following statement:

"This is wise, patriotic, and unselfish action for which the merchants and manufacturers are highly to be commended. It will take time to work out fully its beneficial effects to the country. It will disarm adverse criticism of the jewelry trade in this respect and lead to general coöperation with them. Such is the earnest desire of the department. The jewelry business is a part and an important part of our commerce. It has acted fairly, its normal needs should be considered fairly. Platinum is required for many uses. Every such use has its just claim. None may urge an exclusive demand. All have a part in our common country and the Government of that country seeks through the Department of Commerce to secure for all a due and proper share. To this end the considerate course taken by the jewelers will directly contribute."

Notes of Interest

The number of interned German and Austrian vessels in the United States, Philippines and Pacific island ports was 105, with gross tonnage of 662,513 and net tonnage of 395,498.

Secretary McAdoo, on May 3, turned over a Treasury warrant for $100,000,000 to Italian Ambassador di Cellere. All of this money will be spent in the United States for coal, food and munitions.

Pushing of program for building wooden ships has brought out many large orders for wood-working machinery from Atlantic and Pacific coast yards, preparing to build these boats.

Rail mills have capacity to roll 6,000,000 tons annually, but during the last two years output has been less than 50% because of tremendous pressure for bars for munitions and structural purposes. Not a few rail mills have been utilized to meet demand for bars.

The United States is producing crude steel at rate of 44,000,000 tons annually, but there is a loss of nearly 25% in converting steel into finished products and there is not enough crude steel produced to keep all finishing mills simultaneously working at capacity and not enough bar mills to meet the extraordinary demand.

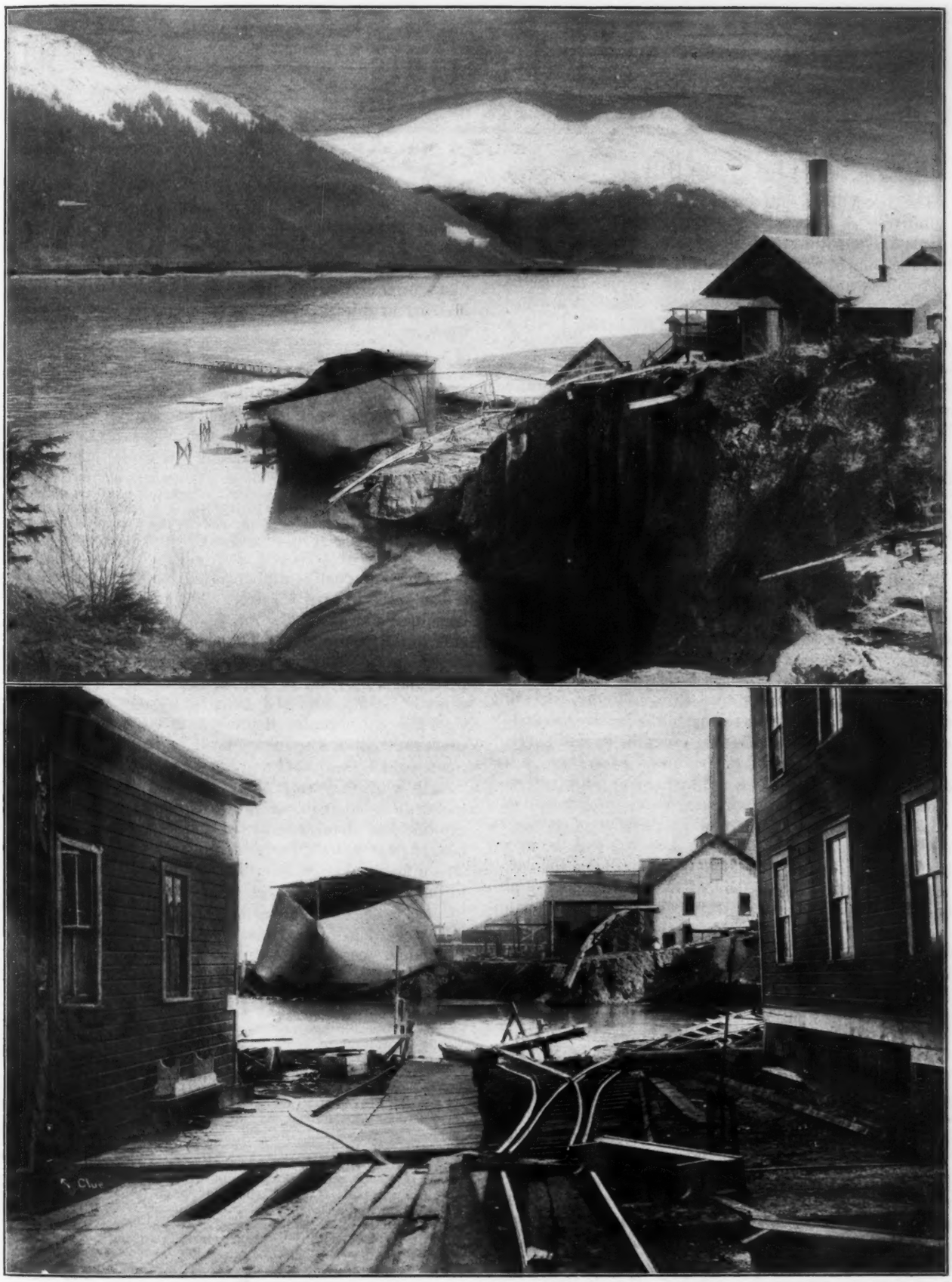
All German ships in American harbors, which were disabled by their crews, will be repaired and ready for commission within 120 days, according to John A. Donald, chairman of survey committee appointed by the shipping board for investigation of the extent to which the vessels had been damaged. Two of these have already been rechristened by authority of Secretary Daniels; the "Kronprinz Wilhelm" and "Prinz Eitel Friedrich" have become the "Baron von Steuben" and the "Baron de Kalb."

Beginning May 9 the Government issues a daily newspaper, giving the news and announcements of all Departments relating to war preparations. The publication, known as the *Official Bulletin*, is issued under the direction of the Committee on Public Information, and will be mailed to all newspapers, commercial organizations, and others requesting it. Postmasters have been directed to post it daily in their offices. Edward S. Rochester, former editor of a Washington newspaper, is editor of the *Official Bulletin*.

Photographs from the Field

VIEWS OF THE ALASKA TREADWELL MINES ON DOUGLAS ISLAND BEFORE THE DISASTER

The white spot in the upper view is the famous "gloryhole." The lower view shows the proximity of the mines to Gastineau Channel and suggests the great danger of the entrance of sea water



SOME EFFECTS OF THE SUBSIDENCE AT THE ALASKA TREADWELL MINES ON DOUGLAS ISLAND

The pond in the center was formerly solid ground. The oil tank, the clubhouse at the left and other lower buildings and the railroad were affected by the mine subsidence and the encroachment of the salt water. The power house and assembly hall are understood not to have been seriously affected.

Editorials

The Tax Bill

The tax bill as introduced in the House of Representatives has aroused a storm of protest—not that the people are unwilling to be taxed and be taxed stiffly, but that they do not want to be taxed in such unscientific ways that will be inequitable and even will cripple the business of a good many. In so far as such complaints are justified, certainly they merit careful consideration. If business be so crippled that it cannot pay the taxes that are levied, the purpose of the bill, which is to raise money, will be defeated. A great deal of money must be raised, and it ought to be accepted as a theorem that it should be raised in ways that will create the least disturbance.

Unfortunately, it was in the first place a mistaken policy on the part of the Treasury Department to undertake to raise so large a percentage of the cost of carrying on the war by immediate taxation. Great Britain after two years of war put its taxes up to a basis of providing about 25% of the expense. We are beginning with 50%. This has compelled the framers of the bill to scrape many sources from which the enormous sum may be obtained. Cross-currents of local interest make it difficult for a large popular assembly to write any revenue bill. The result of the attempt of the Ways and Means Committee is so unscientific that it looks as if that committee had simply shut its eyes and drawn things blindly, expecting that the Senate will rewrite the bill. In the meanwhile the public shows signs of going crazy in its indignation.

Yet the bill has many good features. In so far as it has conformed to the policies of taxing consumption, and especially luxuries, and of raising money by stamp taxes it is sound. Also is it sound in its plan of raising a great deal more money by the income tax, and the excess profits tax, although the method of applying the latter is bad. Perhaps the method of taxing automobiles also is bad; that is, the scheme of putting it upon the manufacturers. Yet the automobile is in the main a luxury and is a fit subject for taxation, such a tax partaking of the nature of a tax on consumption. That would be evident if it were laid directly upon the user, whereas in putting it upon the manufacturer it looks like a tax on production and may affect his sales and consequently his industry. The more equitable thing would be to put it upon the user, which easily could be done, exempting commercial users, physicians and other limited classes if desirable.

The monstrous things about the bill are the provisions for increased customs duties, for excess profits, and for second-class postage. The proposed increase in tariff rates is made without any thought whatever. In putting 10% on all articles now on the free list it disturbs conditions that have existed from time immemorial. It may check the importation of the very things we need for military purposes, take tin for example. It may tangle some of our industries with red tape at a time when the tendency should be toward simplification. Thus, we import a vast quantity of crude copper for smelting and refining, which is now free of duty. Although we export a larger quantity and might escape payment of duties by cancellation of bonds, consider the greatly increased number of officials that would be necessary to attend to such operations. And how would it be if some domestic producers should take the export trade and leave importing refiners high and dry? Moreover, would the Government, desiring to raise money by duties, permit bonding privileges, anyhow?

We shall discuss the matter of second-class postage in a separate article. Let us pass now to the question of excess profits. The new bill repeats the thoughtless language of the present law, which has not yet been interpreted by any authority and nobody at present knows just what it means. The existing law reads thus:

> Actual capital invested means (1) actual cash paid in, (2) the actual cash value, at the time of payment, of assets other than cash paid in, and (3) paid in or earned surplus and undivided profits used or employed in the business, but does not include money or other property borrowed by the corporation or partnership.

Once the actual capital invested has been determined, it is allowed to earn 8% free. Any excess over 8% is to be subject to a tax at the rate of 8%. We are now referring to the existing law. The pending bill raises the rate, but the principle remains the same. But whatever be the percentage, on what is it to be calculated? On invested capital? On capitalized value? Clearly par value of stocks is not meant. Reproduction costs would merely produce endless disputes, especially in regard to those items which are not reproducible. Such things are "worth what they are worth." If we try to find out the money invested at the inception of the company, plus new capital, less depreciation, we soon become lost in the quagmire of figures, correctly remarks the *Evening Post*. The difficulty lies in this: That capital values depend on income, and that they cannot be found independently of income.

In regard to present tax, Prof. E. R. A. Seligman, of Columbia, one of the leading tax experts of the country, writes:

> There is a very great difference between the European taxes and our own tax. All the European laws tax profits in excess of the average profits of a business received before the war began; and in some cases this average is taken for a number of years. Our law, however, takes the arbitrary figure of 8% as the normal profit and taxes all profits over 8 per cent.
>
> In a comparatively new country like the United States, where risks are so great and where losses are so frequent, an 8% profit is ludicrously inadequate. As our present law imposes a tax of only 8% on these excess profits above 8%, the situation is not so serious. But if it becomes necessary to levy a far higher rate of taxation, the continuance of our present method will be hazardous in the extreme. At a period like the present, it is of the first importance not to put a check upon business enterprise or to interfere with the desire of individuals to do their utmost in increasing the productive capacity of the country. The principle of taxing the excess above normal peace profits is indeed defensible; but to penalize all profits above 8% can scarcely be commended. A higher rate upon such excess profits would certainly yield proportionately less revenue, and perhaps even actually less revenue. It cannot be emphasized too strongly, therefore, that if we should decide to levy a heavy excess-profits tax, we should follow the European principle of calculating the taxable

excess and abandon the arbitrary method that has been followed in our present law.

The European countries have generally taxed excess profits by comparison with the average profits during a series of years immediately preceding the war. This method is simple, it gets directly at the excess profits that are due to the war, it emphasizes the ephemeral character of the tax. It is surprising that our Congress persistently shuts its eyes to this simple method and instead of it chooses a mysterious formula whereof neither it nor anybody else knows the meaning. Perhaps, in the scheme for levying this tax there should be a discrimination between excess profits realized in the production of raw materials and those made in manufacturing, trading and otherwise.

The Second-Class Postage Enormity

There are some theorists in the Post Office Department who are saturated with the idea that the newspapers and magazines do not pay enough postage, and who have evolved a wonderful scheme of raising the rates by scales according to a zone system. This project was introduced in Congress last year and was ignominiously defeated, but its promoters bided their time. That came sooner perhaps than they expected. It came when the war revenue bill had to be framed. What was more natural when the confused legislators were racking their brains how to raise money than to slip in this hobby with the specious plea that it would raise millions! And to slip it in just when time was short, when clamor was bound to arise from many quarters, and when equity and reason was least likely to prevail!

We threshed over the arguments last year of how such an impost on the magazines would be more than they could stand, of how it would have to be passed on to subscribers as soon as current subscriptions expired, of how the remote subscribers might have to pay more than the near-by, and so on. We trust that our readers remember those arguments, for the same things that were said then apply now. but more so, for the present situation is worse.

Now, we publishers feel mortified to be making this howl at a time when much money has to be raised by taxation, when everybody is patriotic, when sacrifices must be made and ought to be made cheerfully. We do not want to evade taxation. We want to do our share and considerably more, but we do not want our business to be ruined. Tax our income, tax our profits as is being done, but do not wipe them out so that we shall not have any profits on which to pay, which might readily happen before the burden could be distributed among our subscribers.

The publishers of 86 of the largest and most influential monthly and weekly magazines have stated under oath to the Ways and Means Committee that their average net earnings for 1916 were only $15,000 each, whereas the increased postage bills charged to these magazines under the proposed rates would be in excess of $40,000 each. The increase in rates levied on the few survivors of this strain, they say, would have to be passed on to the reader in the form of higher subscriptions. We showed last year that the increase in the postage on the *Engineering and Mining Journal* to the sixth zone would be $2 per subscription per year.

Representative Mondell, of Wyoming, hit the nail on the head when he said:

"I do not approach this subject in the interests of the newspapers or magazines, but rather as one who desires all information they contain to be national and not sectional in scope. You endanger that nationalism by the proposals in this bill to establish a zone system.

"Dissemination of information is vastly more important than revenue or the welfare of newspapers or magazines. We must have these different points of view if we are to continue as a homogeneous people."

Extinguishment or crippling of the press, and especially that part of it that has a national circulation, is about the last thing that the people of the United States want to do at this juncture; and we do not believe they will permit it if there be time for them to be heard. It is a very real and very immediate danger that threatens both them and us now.

Will the Treadwell Mines Be Recovered?

Since the disaster whereby the rock formation along the Gastineau Channel slipped and let the sea water into the Treadwell mines, it has been a question whether the life of these famous mines had been terminated, whether they might be recovered, or whether operations would be continued along their fringes with only a faint ray of their former glory. Reports and prognostications of several kinds have been published in the papers. Before attempting to form any serious opinion, it is well to consider the recent history of these mines and the precise nature of the accident.

The workings of the Treadwell, 700 and Mexican mines are on one oreshoot—this being a pear-shaped orebody longitudinally, with the large end in the Treadwell and the small end in Mexican ground. The trend of this orebody in depth takes it out of the Treadwell into 700 ground and presumably eventually takes it all into Mexican ground, but unfortunately the gold content faded away at a depth of about 1700 ft. On the 1750-ft. level the average assay was but $1.46; on the 1950, but 65c. However, on the 2100 it rose to $1.65 and on the 2300, to $2.06 per ton. The increase in the lower levels was very encouraging, and a series of diamond-drill holes was sunk below the 2300, which gave an average assay of $2.25 per ton, but it was found that the oreshoot had diminished to 70% of its former average area. However, the diamond-drill holes indicated enough improvement in depth to justify the running of the 2500 and 2700 levels from the central shaft. This was being done with all possible speed, with the expectation of having a new mine below the 2100 level, which would be protected by a solid sheet pillar from the 2100 up to the 1750 level in Treadwell ground and up to the 1600 level in 700 and Mexican ground, when the accident happened.

None of the stopes in the Treadwell, 700 or Mexican mines extended out beneath salt water, but they did on one level extend out to a point nearly vertically under the shore line on the 700 dike fault, and that was the point of sudden subsidence that opened the way for the flood of salt water.

About 3000 ft. easterly on the strike of the ore channel from the above workings are the workings of the

Ready Bullion mine on a second oreshoot, smaller in size than the Treadwell-700-Mexican oreshoot, but otherwise identical in general longitudinal shape and in trend to the east in depth. These Ready Bullion workings are bulkheaded off from the flooded workings, and as the Ready Bullion mine is worked in depth, some attractive ore zone may be encountered. If so, about 3000 ft. of drifting could prospect the Treadwell oreshoot at a corresponding level in order to learn whether or not it has improved in value. If pay ore be found, an effort could then be made to pump out the old workings to serve as a second exit for the resumption of mining operations.

Thus, it will be seen that the reopening of the Treadwell mines is problematical, depending upon the prospects of the Ready Bullion mine in the first place and then upon extensive and costly explorations to find ore at great depth in the Treadwell mines that would warrant an elaborate program for reopening them. We do not know whether the company has yet decided upon anything, but to make the best of it, the outlook is not cheerful.

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Belgian Kiddies, Ltd., subscriptions up to day of going to press, May 16, amount to $91,367.

BY THE WAY

The Trials of a Shift Boss*

Away back in the sulphide stope,
  Just hear that shifter rave;
They've shot out all the timbers there,
  The country's all a-cave.
The muckers can't get out the dirt,
  The trammer's off the track,
And he's been gone an hour now
  And never will get back.
The cager he's not worth a snap;
  He's left all stations full;
The bell cord fell into the shaft;
  The engines will not pull.
The topman put four cars of ore
  By error on the dump;
The water falls into the shaft
  As fast as they can pump.
The contract's moving awful slow,
  For both the teams are green;
They've ruined half a hundred drills
  And broken the machine.
The boys who work for daily pay
  In driving that new drift,
Like funerals they break the dirt,
  Just two cars in a shift.
The sorters are a lovely bunch;
  They get through in great haste.
We've shipped out seven cars today,
  But half the ore was waste.
The nipper's gone to sleep again;
  Oh, he's the prince of fools;
Forgot to send the powder down,
  And never gives us tools.
Now what is that? Oh! what is that,
  The noise that I just heard?
They've broken by their carelessness
The chairs out on the third.
And now they call me back again;
  The transfer chute is stuck,
And just beyond our reach there hangs
  A hundred cars of muck.
Oh, some folks have such lovely times,
  Their life is all a song,
But who can bear a shifter's lot
  When everything goes wrong?
Oh, when that last great tally sounds,
  When Gabriel's trumpet blares,
I'll leave behind the world unkind
  And climb the golden stairs.
I'll reach the pearly gates on high
  And hear St. Peter say:
"O weary pilgrim from the world,
  Whence came thee up this way?"
"From Leadville's mines," I'll answer then,
  "I've shifted there for years."
I'll see him then, his kind heart broke,
  His eyes filled up with tears.
"Oh, welcome, soul," he'll say to me,
  "To mansions in the sky;
You bore the woes of all below,
  Now rest up here on high."
He'll lead me through the pearly gates,
  Right up before the throne;
"The best that heaven has to give,
  Dear shifter, is thine own."

*Written "by a fellow up at Yak mine," Leadville, Colo., and published in the Farmington "Times," Farmington, Mo.

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With the first 4000 returns on the Bureau of Mines' census of mining engineers came requests for 5000 additional query blanks. Many, in furnishing the Bureau with the information as to their own experience, requested that the same form be forwarded to friends.

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From the gold- and silver-mining districts we receive reports of difficulties in operation owing to the scarcity of good miners. The best men are drawn away to the big copper- and lead-mining districts of Montana, Idaho and Arizona, where wages, based on the sliding scale according to prices of the metals, are now very high. This exhibits the working of the law of supply and demand, which operates in labor as in everything else.

⁂

The exact composition of the gases used in modern trench warfare is not known, says a bulletin of the American Chemical Society, but from the appearance, odor and effects on the men, it would seem that most commonly a mixture of chlorine and bromine is employed: possibly at times with the addition of sulphur fumes or formaldehyde gas. Chlorine and bromine are produced cheaply and in large amounts of the Germans as by-products of other industries. They are among the most active chemical agents known, attacking the eyes and the lining of the mouth, throat and nose. They first produce a hard cough, followed by the spitting of blood and finally asphyxiation, due to the destruction of the breathing apparatus. Only one part of chlorine or bromine in one thousand parts of air is necessary to produce almost instant death; one part in one hundred thousand, if endured for any great length of time, is very dangerous.

For use in the trenches the gases are usually liquefied and stored in tanks from which the outflow is regulated by means of a valve. If the ground slopes a little toward the enemy and the wind is in the right direction, the gas, being heavier than air, flows over the ground filling the hollows like so much water. The most successful method for combating the gas attacks is by the use of a gas mask. The modification now employed is a hood, provided with a mica window, that fits down over the head like a bag, buttoning between the vest and shirt. When the first indications of an attack are evident, the hood is moistened with a solution of sodium hyposulphite (the photographer's "hypo") which combines with the gases, rendering them ineffective. Because of the large amount of gas required to poison the constantly changing air, an attack is only of a few minutes' duration. In case one is overcome by the gas, inhalation of dilute ammonia vapors will give great relief, since the ammonia combines with the gas in the bronchial tubes and relieves the difficulty of breathing, although it does not undo the injury already done. Because of the cruel suffering inflicted upon the enemy, the use of poisonous gases in projectiles was forsworn by the signers of the Hague declaration of 1899. The first gas attacks of the Germans took the enemy by surprise and inflicted great losses and an untold amount of suffering. Since then the masks have been so perfected that the troops have lost most of their fear of this ruthless form of battle—thus again emphasizing the fact that this is a war fought by science.

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Taxation on certain metals was urged upon the Ways and Means Committee of Congress during its consideration of the revenue bill, but the proposal met with little favor. Evidently the attempt to single out copper and other metals for taxation last year was defeated so decisively as to preclude the recurrence of the serious consideration of such a proposal. During the time the committee was considering the draft of the bill, Congress was flooded with an anonymous communication urging a tax of $30 per acre-foot on iron and other mineral deposits held out of use. "Such a tax," the circular stated, "would reach speculators only and would break up the greatest evil of the age—the restriction of production." Arguments were presented attempting to show that the high price of mineral land makes production unprofitable.

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The Mount Royal mining district in western New Mexico, though an old one, is practically unknown. It was never "written up" in any publication, as it was one of the fiascos of an old syndicate including the leading interests in the Exploration Co., Wernher, Beit & Co., L. Hirsch & Co., Cie. de Mines d'Or et de l'Afrique du Sud and the French Exploration Co., of which Georges Levy was chairman. This syndicate bought the property of the Mount Royal company about 22 years ago, during the Hamilton Smith régime, and Captain Mein was chairman of the Steeplerock Development Co. that was formed to exploit the Mount Royal area. Commenting on this early exploitation, Harold C. E. Spence, who was personally intimate with the members of the old syndicate, writes: "The trouble with the early exploitation was in the treatment: pan amalgamation only was tried, this method then being in vogue at the old Carlisle mine in the adjoining Steeplerock section. This district is again coming to the front, and the Geological Survey will shortly publish a bulletin on it. By the way, our friend Herbert Hoover had his first position in this district at $125 per month under Louis Janin, Sr., who reported on the properties for the Exploration Co. Hoover was sent from Janin's office to locate the claims properly in 1895-6, and I have found some of Hoover's location notices on the old claims here."

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Mining brokers are usually considered as trouble makers. Occasionally they have their own troubles, too, as the following letter received by one of them will prove:

Being "interested," for "Legal reasons," and an "ordinary person" in mining, things pertaining to, as Financial part, issuing of Securities, Booklets, Circulars, Phamplets, Lists, Literature, etc. by you of, or they or same, I write you for same, also for above said of the —— —— —— and as the Blank Trust Company, is Transfer Agent, and the Dash National Bank, is Registrar of its issues, which institutions are all in New York City, New York, I ask for meaning of Titles as Registrar and Transfer Agent, of course in your and their way, for I have my understanding.

Sir:—

Also if no trouble, if not to late for above said please assist in getting such, for whatever Booklets, Phamplets, Literature, etc. telling of your Concern, its Organization, Personnel and Business and Legal Opinions of above said —— —— —— by Messrs. Brief & Case, New York, Verification of Books and Accounts by Messrs. Price, Waterhouse and Company, and the Examination and Appraisal, by the American Appraisal Company, that is reliable information of same.

Sir:—

Hoping to receive aggreable reply, and that name and address of mine be placed on file, enclosed find postage,

Yours truly,

—— ——.

The name signed is a good English one at that.

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Reports of copper and other minerals in the Arctic by Amundsen's expedition is now complemented by similar mineral evidence in the Antarctic, as noted by Lieut. Sir Ernest H. Shackleton, who stopped in New York recently on his return to England. The information conveyed is rather meager, but some portions of an interview by an *Evening Post* representative will be interesting. Contrasting Antarctic conditions with those of the North, Sir Ernest said: "In the Arctic you have a polar stretch of open water surrounded by land masses. In the Antarctic you have a great central land mass with an area greater than the United States, about 4,500,000 square miles, with a mean altitude of 10,000 ft., surrounded by oceans." "Are you satisfied that Antarctica is one great land mass, and not a group of islands?" he was asked. "I am personally satisfied," replied Sir Ernest, "but of course that is one of the most debated questions concerning the Antarctic. The old idea was that there were two major masses, which were separated by a channel running from about the indentation of Weddell Sea to Ross Sea. But we found land 5,000 ft. in elevation 10 miles from the Weddell Sea in this location, and we found granite rock in near-by waters. We also established the non-existence of New South Greenland. It had been chartered for many years as skirting the shore of Weddell Sea from about the point of the supposed division between the two land masses of Antarctica. But we sailed the "Endurance" right over the central portion of New South Greenland, and, indeed, she was sunk in the middle of it. We wiped thousands of square miles of land off the map." He told of discovering a vein of coal that cropped out on the surface for 15 miles. "But I don't think it will be mined just yet," he added, "for it is several hundred miles over the ice from the coast. We also found copper."

Personals

Walter Douglas left New York on May 15 for a three or four months' trip to the West.

A. F. Kuehn has arrived at London, via the United States, from the Bawdwin Mines, Burma.

W. H. Aldridge has left New York for Arizona on business that will keep him away about two months.

Norton E. Isbell has been made consulting mining engineer for the Gilpin-Eureka Mines Co., Central City, Colo.

James French, general manager of the Phelps Dodge properties, visited the Morenci branch of that corporation last week.

William Hague, of Grass Valley, Calif., has a commission as First Lieutenant in the 8th Reserve Engineer Regiment, from California.

E. Fisher, formerly with the Federal Mining and Smelting Co., Wallace, Idaho, is now with the Braden Copper Co., Sewell, Rancagua, Chile.

Ernest Witteman has been appointed assistant superintendent of concentration for the Arizona Copper Co., at Clifton and Morenci, Ariz.

George D. Van Arsdale, of the Phelps Dodge Corporation, will leave New York soon for a visit to the company's operations in the Southwest.

A. C. H. Gerhardi has taken over the management of the Wall Street Copper Co., the mines of which are at Luning and offices at Goldfield, Nev.

Frank McLean, superintendent of the Phelps Dodge mines at Morenci, left with his family May 9 for a six weeks' vacation at Long Beach, Calif.

Carl E. Grunsky, Jr., of San Francisco, is a Captain in the 8th Reserve Engineer Regiment, from California.

M. A. Quigley, of Mount Carmel, Penn., has been appointed inspector in the Department of Commerce to specialize in machine-shop inspection.

R. S. Black, general manager of the Kalgurli gold mine, West Australia, has been elected president of the Australian Institute of Mining Engineers for the current year.

Seeley W. Mudd is a Major in the 8th Reserve Engineer Regiment, from California, one of the units that will form the first contingent of American troops in Europe.

Hon. G. Howard Ferguson, Ontario Minister of Lands, Forests and Mines, who has been in ill-health for some time, has gone on a trip to the West Indies and will return in about a month.

Thomas Morrison, of Pittsburgh, a director of the United States Steel Corporation, and Charles Hayden, of Hayden, Stone & Co., have been elected directors of the International Nickel Co.

C. D. Dyer, vice president of the Shenango Furnace Co., Pittsburgh, has been appointed a member of a subcommittee of the committee on raw materials of the Council National Defense.

H. M. Wolfin, chief mine inspector of California, has gone to Reno to arrange with Edward Steidle, in charge of Bureau of Mines a new mine rescue car, for itinerary in Nevada and California.

Capt. Stewart M. Thorne, who prior to his enlistment as an engineer with the Canadian forces, was manager of the Trethewey mine, Cobalt, has been decorated by the French government with the Croix de Guerre.

Arthur S. Dwight is a Major in the 1st Reserve Engineer Regiment, from New York. This will be one of the first American regiments to go to Europe.

H. H. Stout, assistant to the president of the Nichols Copper Co. is back in New York from a trip to San Francisco, where he spent a large part of the time in a hospital. He is now well along toward complete recovery from his illness.

Bradley Stoughton, secretary of the American Institute of Mining Engineers, will be the principal speaker at the first annual banquet of the Steel Treating Research Club of Detroit, on Saturday, May 26. His subject will be "The Possibilities of Double Heat Treatment."

H. E. Whitefield, professor of engineering, the University of Western Australia, spoke recently before the Pittsburgh section of the American Chemical Society. He referred to the numerous blunders made by Great Britain in manufacturing munitions during the early stages of the war.

Capt. William Holman, formerly with the Judson Mining Co., in Michigan, has taken charge of the new shaft-sinking department of the E. J. Longyear Co., of Minneapolis. Captain Holman went to Norway for the company several years ago in connection with the sinking of the Wallenberg shaft at Lökken, Norway, and is at present directing the shaft-sinking work which the E. J. Longyear Co. has recently started on the Cuyuna Range for the Pittsburgh Steel Ore Co.

Obituary

W. J. Wimer, a pioneer placer miner, died at Grants Pass, Ore., Apr. 24. Mr. Wimer has operated placer mines for 45 years, and was owner of the Day Gravel mine at the time of his death.

Edouard Saladin, the French government representative in this country in the purchase of railroad material and supervisor of the making here of shell steel, who died Feb. 12 after a two months' illness resulting from a paralytic stroke, was earlier in his career engaged in this country. Following work in Norway, Indo-China, Spain and Mexico, he was manager of a French mining company operating at Junction City, Trinity County, Calif. He will, of course, be remembered chiefly as a leading figure of the ordnance and steel-making institution of Schneider & Co., Le Creusot, France. He was a prominent member of the International Congress for Testing Materials, held in New York in 1912, where linguistic abilities like his were at a premium. He was born at Nancy, France, in 1856, and was graduated first in his class in 1877 from the Ecole Polytechnique, the school for officers in France, and then in 1880 from the Ecole des Mines de Paris. Among his numerous contributions to metallurgical advance may be mentioned a new autographic method to ascertain the critical points of steel and steel alloys.

Arnold Hague, geologist and explorer, died on May 14, at his home in Washington, D. C., in his seventy-seventh year. He had been a member of the United States Geological Survey since 1879 and did much toward developing Yellowstone Park. The son of Dr. William Hague, an eminent clergyman, Arnold Hague was born in Boston, Mass., Dec. 3, 1840. He entered Yale University and was graduated from the Sheffield Scientific School in 1863. He then entered the universities of Goettingen and Heidelberg and the Freiburg School of Mines. In 1866 he returned to the United States and soon became assistant geologist on the United States geological exploration of the fortieth parallel under Clarence King. After the completion of this survey Mr. Hague went to Virginia City, Nev., to study the geology of the Comstock lode and the "Washoe process" of procuring gold from ore. He then confined himself to the study of lodes and ore in the mining regions, traversing the Sierra Nevada range in his researches. He was made government geologist of Guatemala soon after this and later spent much time in South America. In 1878 the Chinese government engaged him to examine the gold, silver and lead mines of northern China, where he remained a year. He became geologist, with charge of the work in the Yellowstone Park district in 1879 and there he did his best work. The degree of Sc.D. was conferred on Mr. Hague by Columbia University in 1901 and five years later that of LL.D. was given him by the Aberdeen University. He was a member of the United States Geological Society and its president in 1910; of the National Academy of Sciences, Geological Society of London and the American Philosophical Society. He also belonged to the Century and University clubs of New York and the Metropolitan and Cosmos clubs of Washington.

Societies

American Mining Congress has decided to abandon this year's convention in order to avoid detracting from the aid it may extend to the Government during the war.

Engineers Society of Western Pennsylvania has removed to new quarters at Rooms 565-69, Union Arcade Building, Fifth Avenue and William Penn Way, Pittsburgh, Penn.

Mining and Metallurgical Society of America, New York section, held a meeting at the Engineers Club on Thursday, May 17. The meeting was preceded by an informal dinner. The object of the meeting was to further discuss ways and means for mining and metallurgical engineers to assist the Government.

Iron and Steel Institute. The annual meeting of the Iron and Steel Institute (London) will be held on Thursday and Friday May 3 and 4, at the house of the Institution of Civil Engineers Great George St., Westminster. At this meeting the Bessemer medal will be awarded to Andrew Lamberton. General technical papers will be read.

Royal Canadian Institute—The annual meeting was held in Toronto on the 5th inst. Prof. J. C. McLennan, the president, in his annual address dealt with scientific research in its relation to industrial development and the work of the Institute in directing attention to the problems requiring a scientific solution arising from the war. J. Patterson, the secretary, detailed the operations of the Institute's bureau of industrial and scientific research, the plans of which had been endorsed by several commercial and technical organizations. The following officers were elected: President, J. Mivvray Clark, K. C.; 1st vice president, Prof. J. T. Field; 2nd vice president, Dr. George H. Locke; Secretary, J. Patterson; Treasurer, W. B. Tindall; Council, Prof. McNurrich, Prof. Baines, E. P. Mathewson, H. W. Shapley and Prof. Dawes.

American Association of Engineers will hold its third annual convention at Chicago, May 14 and 15, to elect national officers for the ensuing year and to consider proposed changes in the National Constitution, in order that the association may act along the most democratic lines. The convention will be open to all members. The convention will not take action to bind the Association but will nominate slates and draft the proposed changes into shape to submit to all members for a vote. Each and every member is invited to participate in making nominations and proposing changes to be considered at the convention and each certified member will be entitled to vote on these matters by mail after the convention has considered them. It is claimed that this action will permit an actual government by the membership.

The Association has tripled its membership since the last annual convention.

American Society of Mechanical Engineers will hold its spring meeting at Cincinnati, May 21 to 24, 1917. Since this is the first large conference of American mechanical engineers since the entrance of our country into the war, the event will assume particular importance. Some papers of technical importance will be presented, among which will be: "A Foundation for Machine Tool Design and Construction," A. L. DeLeeuw; "Machine Shop Organization," Fred G. Kent; "Metal Planers and Methods of Production," Charles Meier; "Tests of Uniflow Steam Traction Engines," F. W. Marquis; "Relation of Efficiency to Capacity in the Boiler Room," Victor B. Phillips; "Radiation Error in Measuring Temperature of Gases," Henry Kreisinger and J. F. Barkley; "Development of Scientific Methods of Management in a Manufacturing Plant," Sanford E. Thompson and Associates; "Disk Wheel Stress Determination," S. H. Weaver (by title only). Two munitions sessions will be held and the papers to be presented include: "Munitions Contracts and Their Financing," Frederick A. Waldron; "Organizing for Munitions Manufacture," Arthur L. Humphrey; "Organization for Munitions Manufacture," Harry L. Coe; "Procuring Special Machines for Munitions Manufacture," H. V. Haight; "Practical War-Time Shell Making," Lucien I. Yeomans; "The Design of Munitions for Quantity Manufacture," J. E. Otterson; "Procuring Materials for Munitions," C. B. Nolte; "Limits and Tolerances for the Manufacture of Munitions," A. W. Erdman; "Gages and Small Tools," F. O. Wells; "The Importance of Intelligent Inspection in Munitions Manufacture," E. T. Walsh. Features of social interest will also be provided.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Classifier—Movable-bottom-screen Jigger. Harry J. Moyer, Philadelphia, Penn. (U. S. No. 1,225,158; May 8, 1917.)

Crushing—Rotary Mill. Fred Allen Jordan, Duluth, Minn., assignor of one-half to Walter G. Swart, Duluth, Minn. (U. S. No. 1,224,933; May 8, 1917.)

Drill—Sewell S. Hensley, Mexia, Tex. (U. S. No. 1,225,629; May 8, 1917.)

Drilling—Well Casing. Peter Boyd, Beaver, and Augustus M. Saunders, McKeesport, Penn., assignors to National Tube Company, Pittsburgh, Penn. (U. S. No. 1,225,005; May 8, 1917.)

Flotation-Cyanidation — Method of Treating Ores. Harry Louis Friberger, Eureka, Kan., assignor of three-tenths to Victor C. Joslyn and three-tenths to Cornelius Horatius Keller, El Paso, Tex. (U. S. No. 1,224,917; May 8, 1917.)

Lamp—Acetylene Lamp. James Deans Cumming, Copper Cliff, Ont. (U. S. No. 1,225,016; May 8, 1917.)

Lead-Sulphide Ores—Treatment of Lead-Sulphide Ores to Produce Lead Sulphate. Percy C. H. West, London, England. (U. S. No. 1,225,296; May 8, 1917.)

Metallic Chromate Process—Process for Manufacturing Metallic Chromates. Kebe Toabe, Winchester, Mass. (U. S. No. 1,225,374; May 8, 1917.)

Rescue Work—Breathing Apparatus for Use in Noxious Gases. James W. Paul and Clarence Hall, Pittsburgh, Pa.; said Paul assignor to said Hall. (U. S. No. 1,225,269; May 8, 1917.)

Smelting Furnace—Oil or Gas Burning Smelting Furnace. Oliver P. Moore, Spokane, Wash. (U. S. No. 1,225,470; May 8, 1917.)

Tube-Mill Grinding—Grinding in Tube Mills. Oscar Schultz, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,225,061; May 8, 1917.)

Editorial Correspondence

SAN FRANCISCO—May 10

Safety Rules for Dredges were prepared at San Francisco by a committee composed of dredging men and members of the State Industrial Accident Commission in session in the last week of April. The committee is composed of L. D. Hopfield, of the Natomas Co. of California; C. W. Gardner, of the Yuba Consolidated Gold Fields; Harold Mestre, consulting engineer, employed by various dredging companies in safety work; Carl Brown, representing the California Insurance Merit Rating Bureau; A. L. Wilde, representing the Brotherhood of Dredge and Steam Shovel Men; Robert L. Eltington, electrical engineer representing the State Accident Commission; F. L. Lowell, deputy state mine inspector, in charge of dredge inspection; H. M. Wolflin, chief state mine inspector. The mine division of the commission has in preparation a bulletin by Mr. Lowell on dredge inspection and safety work. It is noteworthy that in several items of this bulletin members of the dredge-rules committee have offered suggestions that are even more drastic than the rules suggested by Mr. Lowell. Although embraced in the mine inspection under state authority, the inspection of dredges was delayed and rules governing were not included in the mine-safety rules prepared by the accident commission. The superintendents and managers of dredging companies, however, have been constantly improving the safety of the operations and have worked in harmony with the commission. As great interest in the prevention of accidents has been shown by the dredge operators as by the hydraulic and lode miners.

BUTTE—May 10

Additional Secret-Service Men have been brought to Butte in the last 10 days. The activity of the secret-service department of the government and the special officers of the companies has prevented German sympathizers from making any important moves. Every man who is known to be out of sympathy with this country in the present war is under constant surveillance. In addition to the detectives, the force of United States soldiers has been increased and placed at points where they can be utilized to the best advantage in case necessity arises. The Anaconda and other mining companies are fully awake to the fact that among the 25,000 men employed in the mines of Butte and smelteries at Anaconda and Great Falls, are many radical opponents of the present war with Germany. Some of these belong to the socialist element that is opposed to any wars, except wars on capital. Besides Germans and Austrians whose sympathies may be with their native lands, there are many radical Irish revolutionists who are so bitter in their hatred of England that they carry it into the existing situation and sympathize with Germany.

Cost of Recent Mine Fires at Butte has not been realized by many people, and indeed can hardly yet be estimated in dollars and cents. The actual fire damage probably exceeds that of any previous mine fire in Butte and the loss of production is likewise a serious one. The ore zone affected has a length of 600 ft. and takes in part of the stopes of the Tramway, Leonard and West Colusa mines on every level from the 2200 to the surface. From this zone previous to the fire the Anaconda company was taking 2000 tons of ore per day on the Tramway side, 1000 tons from the Leonard stopes and 1000 from the West Colusa; a total of about 4000 tons per day was thus cut off. From the ores that were mined there, the Anaconda company was producing from 250,000 to 300,000 lb. of copper per day. The area known as the fire zone of the Tramway, Leonard and West Colusa mines, has been hermetically sealed by concrete bulkheads from the surface down to the 2200-ft. level, shutting off communication and air from a rich section of the district from which in the past few months thousands of tons of ore had been taken. During the month of April a force of close to 700 men was kept at work putting in the concrete bulkheads and fighting the fire. At present there are 400 men on the rolls doing this. When the fire broke out, the Anaconda company secured every concrete mixer in the Butte district and brought in a number from outside. Fifty teams were put to work hauling sand and cement. Every foot of 1-in. lumber in the lumber yards of the district was bought for use in making the forms. A feature of the recent fires has been the extreme care, exercised by all the mining companies involved, to take no chances on losing human lives. All told three men lost their lives. They were caught before the conditions were known and died from the effects of the gases. After the conditions were discovered the mines affected were closed promptly and kept closed as long as there was a possibility of the miners being in serious danger.

DENVER—May 11

Smelter Investigation, authorized by the last legislature, has begun. Henry P. Nagle has been appointed secretary of the board and Fred R. Marvin assistant secretary, with headquarters in the capitol. Trips are planned to every portion of the state to investigate complaints. The first trip is taking place this week, covering districts in Clear Creek county.

Ferberite Tungsten District in the Boulder field is experiencing a revival. The Red Sign mill of the Primos Chemical Co., with a capacity of 50 tons per day, is completed, and will treat custom ores as well as the production of the Red Sign mine. This will be a strong factor in inducing new work in the district. The Black Prince mill, built last year, is operating steadily; capacity of this plant will be increased to 50 tons daily, and a tramway built from mine to mill. The Consolidated Leasing & Mining Co., a Denver organization, is driving a crosscut tunnel on the Black Prince group to open the vein at considerable depth. The refining plant at Boulder is buying tungsten concentrates from milling plants at a premium over New York prices; this is a further inducement to increase production.

Shortage of Labor in Cripple Creek is assuming serious proportions. A few weeks ago, due to this shortage, the Portland and Vindicator mines were forced to discontinue the night shift, working everyone on day shift. Many young men are now enlisting in the service of the Government, which will tend to make the situation more acute. Due partly to this shortage and partly to the fact that lessees were paying more than the regular wage scale of the district, and therefore getting the best men, all $3 and $3.50 men were raised 50c. and all $4 men 25c. per day. The raise was initiated at the Cresson mine, where the men threatened to strike, and was then taken up generally throughout the district. It was agreed by the principal mines of the district not only to start the new scale on the first of May, but to also pay the new scale to those who had worked during the month of April.

Leadville's Manganese Ores have never found much market outside of Colorado for the reason that they are of too low in manganese content, as a rule, to stand high freight charges. At present, however, they are being investigated by large eastern steel manufacturers. These ores, having always an association of iron with the manganese, are a splendid flux for the lead furnaces of the state. When sold to such smelteries, the shipper receives pay for his silver and for the manganese as though it were iron. The Colorado Fuel and Iron Co. has lately purchased considerable tonnages of the better-grade ore. It is low in phosphorus and the freight on the iron is no greater from Leadville to Pueblo than it is from the company's iron mines in Wyoming. Leadville can supply large amounts of straight-oxide ore that will run 45% to 48% of manganese and iron. One mine developed, this last winter, a great shoot averaging about 32% Mn., 16% Fe., 12% SiO_2 and 0.054% P. In the Chrysolite, on Fryer Hill, close to town, lessees have exploited a large body that runs about the same except that the percentages of manganese and iron are practically reversed. Home Extension mine ships 50 tons daily to the Minnequa steel works from a new find and will increase this production. Carbonate mine, on Carbonate Hill, recently developed similar ore, and the Penrose (Downtown Mines Co.) has been shipping such ore for some time.

SALT LAKE CITY—May 11

Workmen's Compensation Act is shortly to be put in effect in this state and the practical working out of the act is now being arranged. As a preliminary to the operation of the new law, an opinion by the attorney-general's office, handed down at the instance of the state industrial commission, holds the act to be obligatory upon both employer and employee, and not elective. Employers of more than four employees—except in the field of agriculture and domestic service—are required to make reports as to the number of employees engaged in each class of employment, the scale of wages paid and the aggregate wages. At an open meeting held May 7, the state industrial commission adopted the compensation rates to prevail in all industries of the state, except coal mines. It was announced that the commission had not decided on the form of policy to cover all industries for casualty insurance, and this will be left largely to the casualty companies. The matter of merit rating will be taken up when the commission has adopted rates for coal mines. Among sample rates, read at the meeting, which may be of interest here, were: Assaying, $1.68; ore concentration and amalgamation, $4.04; smelting, $6.11. The rate given is the premium rate for each $100 of payroll.

Eight-Hour Day, for men who previously worked 10 hr., was officially announced on May 9 by the Utah Copper Co., the American Smelting & Refining Co., the Garfield Smelting Co., and the Bingham & Garfield Ry. No reduction in the wage scale was made except in the case of day labor, which is to receive $2.70 a day for 8 hr. in place of $2.80 a day for 9 hr. This gives machinists and mine carpenters the time reduction for which they have been contending, but in the case of the latter there has been an additional request for an advance to $6 a day in wages. The mine carpenters decided on the evening of May 10 to ask informally for the wage increase, although many of the members opposed such an additional demand. The 8-hr. day will not apply to this class of workmen until the matter of the wage increase is disposed of.

PHOENIX, ARIZ.—May 10

Swansea Consolidated Gold and Copper Mining Co. may be taken out of bankruptcy. In the United States court, Judge Sawtelle is considering an unopposed application made by the trustee for permission to pay off the debts of the corporation and to discharge it from bankruptcy. On hand is $150,000, which will pay off all floating indebtedness and leave $30,000 balance. This is without regard to the $1,000,000 bonded debt of the company, which is to be allowed to stand. The Swansea company has about 3,000,000 shares of stock outstanding. Most of it is held in northern France, Belgium and Holland. At the time of the bankruptcy, 2½ years ago, President Fenau was a resident of Lille, France. Nothing has been heard from him for months past and it is thought that he has been killed in the war which had enveloped his home. Last month at a stockholders' meeting, William Schutte of Amsterdam, Holland, was elected to succeed him. A large part of the European holdings had been pooled some time ago and here was represented by J. G. Vonderseekamp. The property has been sought by the Douglas interests, mainly to secure a year's use of the smeltery, which now lies idle. Though no official confirmation has been given, it is understood that a lease on the whole property will be given the Clarks, the profits to be divided between them and the company.

NOGALES, ARIZ.—May 10

Chispas Mine Was Seized and operated by local officials of the Carranza government at Arizpe. A mining engineer coming out of northern Sonora recently reported that the branch Fomento office at Arizpe lately ordered the management of the Chispas mine to raise the wage scale, employ more men and increase production; the wage scale was to be increased so that men receiving three pesos would get 3½ pesos and those receiving four pesos were to be raised to five pesos, etc. This the manager, Mr. Pedrazzini, refused to do. He was thereupon arrested and confined in jail at Arizpe and notified that the next day he could get a lawyer and witnesses and defend himself. As this promised to be a futile procedure, when he saw an opportunity to escape, he fled and went up to Cananea and across the border at Naco. Then the government official seized the mine and began operating it for the theoretical benefit of the Carranza government. Some of the other mines in the Arizpe section were also ordered to adopt the increased wage. A later report is that the government official found no profit in operating the Chispas mine and that it has been closed. Other Sonora mine operators have been afflicted with this new activity on the part of officials of the Workmen's Council, provided in the new constitution, and have been ordered to increase working forces, raise wages and conform to various other provisions of the constitution, among which is a distribution of a percentage of the profits. The arbitrary orders of government officials as to increasing working forces have not been obeyed in many cases and some arrests have been made, notably at Cananea. Mine operators generally have disregarded such orders as might interfere with the economical and profitable operation of the mines. These conditions seem to prevail only in Sonora. So far as can be learned, other states have not taken up this official interference with the mine operations. The broad provisions of the new constitution may easily stifle mining activities. If the Carranza government is dis-

posed to interpret and administer the new constitution in such a manner as to leave no profit, the looked-for revival of mining will not take place. The sooner the government takes a definite stand, assuring mine operators that they will be permitted to run their mines on business principles, the sooner will the mining industry take on the activity necessary to the prosperity of many of the Mexican people.

DULUTH, MINN.—May 11

I. W. W. Activities of Last Year were so distasteful to law-abiding Minnesotans that definite steps have been to prevent a recurrence of the violence that characterized the 1916 strike. The legislature of Minnesota has passed a law making "criminal syndicalism" or the advocacy thereof a felony. Criminal syndicalism is defined as "the doctrine which advocates crime, sabotage (this word as used in this bill meaning malicious damage or injury to the property of an employer by an employee), violence or other unlawful methods of terrorism as a means of accomplishing industrial or political ends." The advocacy of such doctrine whether by word of mouth or written is a felony punishable as in this act otherwise provided. The act specifies that: "Any person who by word of mouth or writing advocates or teaches the duty, necessity or propriety of crime, sabotage, violence or other unlawful methods of terrorism as a means of accomplishing industrial or political ends, or prints, publishes, edits, issues or knowingly circulates, sells, distributes or publicly displays any book, paper, document or written matter in any form, containing or advocating, advising or teaching the doctrine that industrial or political ends should be brought about by crime, sabotage, violence or other unlawful methods of terrorism," etc., is guilty of a felony punishable by imprisonment in the state prison for not more than five years or by a fine of not more than $1000 or both. Further, whenever two or more persons assemble for the purpose of advocating or teaching the doctrines of criminal syndicalism defined in this act, every person voluntarily participating therein by his presence, aid or instigation is punishable by imprisonment in the county jail for not more than 10 years or by a fine of not more than $5000 or both. And the owner, agent, superintendent or occupant of any place, building or room who wilfully and knowingly permits therein any assemblage of persons prohibited by provisions of Sec. 3 of the act, or who, after notification that the premises are so used, permits such use to be continued, is guilty of a gross misdemeanor, punishable by imprisonment in the county jail for not more than one year or by a fine of not more than $500 or both.

JOPLIN, MO.—May 12

Sale of Tar River Mine for $200,000 has just been announced. The property was developed by O. Longacre, Jr., of Joplin, and is located in the camp of Tar River, Okla., a short distance southwest of Picher. The Tar River Mining Co. encountered much water at first, and though the mill was completed last June, development was slow. The water problem no longer bothers and recent production of the mine has been decidedly good. Operations are now being carried on at a depth of 213 feet. L. S. Skelton, Okmulgee, Okla., who has large interests in oil and other industries, was the purchaser. The Tar River company, however, retains 20 acres which it will develop.

Erection of Four New Mills in the Oklahoma section of the field has been decided upon by the Eagle-Picher Lead Co. This company, which by its extensive development work was almost wholly responsible for the opening up of the great new zinc- and lead-producing area north of Commerce, Okla., and south of the Kansas-Oklahoma state line, already has five mills in operation, including the Netta, one of the largest mills in this district. Last week the Netta alone made over 600 tons of concentrates. The four new mills will be thoroughly modern, electrically equipped plants, each provided with an independently operated slime department. One will be erected just west of the Netta mill, another a short distance to the north and a third a short distance to the northeast, while the fourth will be built about a mile to the southwest, near the camp of Tar River. A. E. Bendelari, of Joplin, is in charge of these operations and this week has ordered new shafts started where necessary and headframes at the shafts already down. It is hoped to have all four mills in operation within four months. Three will have a capacity of 400 tons per shift and the other of 300 tons. When they are placed in operation, the total output of the Eagle-Picher mines in this field should be well over 1000 tons of zinc and lead concentrates per week.

TORONTO—May 14

Wage Situation was taken up by the miners at their annual convention held in Cobalt on May 3, when they decided to make a demand for increased wages. The union announced its intention of writing to the different managers asking for a conference. If this conference is not held the union "will take further steps." It is a foregone conclusion that the managers will not meet a committee from the local union, as this is a branch of the Western Federation of Miners to which the managers are bitterly opposed, and with which they absolutely refuse to have anything to do. It is possible, however, that when this conference is not held, that before voting for a strike, an appeal may be made to Ottawa for a royal commission to investigate conditions. The demand is for a straight increase of 50c. a day to all workers. In Cobalt on the present price of silver the employees are receiving an additional 50c. a day as a bonus, so that except for the recognition of the union the points at issue are not far apart, and it is doubtful if the men would strike. In Porcupine, however, conditions are different. There the men have received no increases and the high prices of supplies and the poor class of labor has borne so heavily on the mines that they would sooner shut down than grant an increase. Wages are so arranged that most men can work on a contract or bonus system, and with even ordinary application can receive considerably more than their base wage. They have not taken advantage of this, however, except among the better class of men, of whom unfortunately there are few. There is a real shortage of men and those remaining are trying to take advantage of the present situation. The situation here is rather obscure and mine managers do not seem to care whether the men strike or not and would be quite content to close down the mines and do nothing except development. Strike or no strike, the worst is not over in Porcupine. Nearly all the mines have had to curtail their operations and a further decrease in the number of men will result in still further curtailment. As there is little possibility of augmenting the number of foreign laborers, and as there is still a heavy demand for men for overseas and for agriculture and other purposes at home, the future for gold mining in Porcupine for the next year or so does not look bright.

The Mining News

ALASKA

ALASKA MINES CORPORATION (Nome)—Has acquired Anvil-Surprise ground, and additional Nome property is under negotiation.

TYNDALL & FINN (Berry)—Option taken by Falcon Joslin, presumably for Kennecott interests, relinquished Mar. 29 except on Ryan holdings, after considerable underground exploration. Tyndall & Finn continuing work on Bondholder group; adit in 735 ft. and must be advanced 100 ft. to cut the vein; several shallow shafts on Mohawk group are in ore and small mill may be erected this season.

ARIZONA

Cochise County

CALUMET & ARIZONA (Douglas)—Production of company in April was 5,900,000 lb. copper.

RED MOUNTAIN COPPER (Wilcox)—New company shipping three to four carloads 5% ore per month; 70-ft. shaft in ore, principally sulphides. J. W. Angle, general manager.

KING COPPER (Rodeo, N. M.)—New organization, of Nat P. Wilson and Denver associates, has taken over property of Cochise Consolidated in Chiricahua Mountains, 18 miles northwest of Rodeo; will spend $75,000 in development and enlarging surface plant; Wilfley tables and flotation equipment will be added to 250-ton mill. Walter Wilson, superintendent.

Graham County

ATLAS COPPER CO. (Safford)—This recently organized company has taken over the San Juan group of 13 claims, 3 miles north of Safford; besides some surface ores, drilling is reported to have indicated 960,000 tons averaging 3.65% copper. Developments consist of about 2500 ft. of drilling, a main shaft 325 ft. deep and 750 ft. of drifting. Shipments, mainly of surface ore, have been made. Mine is equipped, but company contemplates a 300-ton mill. R. W. Craig, of Phœnix, is president. T. J. Sparkes, of Phœnix, is secretary. Andrew J. McElhinney, 34 Nassau St., New York, is a director.

Greenlee County

ARIZONA COPPER (Clifton)—April output 5,000,000 lb.

Mohave County

CERBAT COPPER CO. (Chloride)—Adit in 75 ft. with face in good ore. S. W. Klass, Kingman, Ariz., general manager.

RATTLESNAKE (Chloride)—Frank Braly and two partners sinking shaft to the 200; now down about 80 ft. along vein. About 30 tons of good gold-silver-lead ore is in the ore bins.

WESTERN ORE CONCENTRATION CO. (Chloride)—Construction progressing rapidly on this new mill—generally known as the Steffy custom mill. May start June 15. Capacity 250 tons daily but has been offered double that amount and additional equipment may be installed. F. E. Steffy, superintendent.

SCHUYLKILL (Chloride)—About 40 men employed. Shaft sunk from the 500 nearly to the 800 level without attempting any lateral work. Good milling ore developed above the 500 and if found at the 800 a 125-ton mill is to be built. T. J. Torpie, recently appointed superintendent.

EMERALD ISLE COPPER (Chloride)—This company operating experimental leaching plant about three miles south of Chloride. Now bringing in power line for first unit of commercial electrolytic plant; four large leaching tanks installed; estimated capacity 70 tons of ore daily.

TENNESSEE (Chloride)—Chloride's largest producer now working on 1600 level where ore was found of good grade and width. About 200 tons daily shipped to the Needles mill. Mine owned by Needles Milling and Smelting Co. owned in turn by the U. S. Smelting, Refining and Mining Co. N. E. Churchill, superintendent.

BULLION HILL MINES CO. (Chloride)—Owned by the Jesse Knight interests of Provo, Utah. Has complete electrically driven mining plant, but shaft sinking is delayed by failure of power company to extend line from its Chloride transformer station; poles now distributed and construction will be commenced within a few days. H. M. Eakins, superintendent.

Pima County

TUCSON-ARIZONA COPPER (Tucson)—East shaft, 100 ft. deep, is to be sunk 200 ft. deeper; lateral work being done at 100-ft. level, ore having dipped out of shaft. West shaft down 75 ft. in ore; new equipment required soon.

Santa Cruz County

HOSEY (Patagonia)—Strike of high-grade copper ore recently made at this mine about 10 miles north of Patagonia. Has been shipping for six months.

Yavapai County

CALUMET & JEROME (Jerome)—Two new pumps and 50-hp. motors to operate same, have been ordered. Shaft down 410 ft., in schist with a little quartz.

ARKANSAS & ARIZONA (Jerome)—Diamond drilling will be done on 1640-ft. level. Work in east crosscut suspended, but will continue in drift south along contact.

EMPRESS COPPER MINING (Wickenburg)—New company to revive the old Swallow mine, 12 miles east of Wickenburg; recent shipment of 42 tons of copper-gold ore made. C. K. Hartley, superintendent.

UNITED VERDE EXTENSION (Jerome)—President James S. Douglas announced that company had decided to purchase $500,000 of the Liberty bonds.

JEROME VERDE (Jerome)—Drift to be run northward from Columbia shaft to connect with one from which diamond drill is operating; another drift will be run northward but more easterly, and territory explored by drilling. President Berry is to be succeeded by E. O. Holter; Henry Osborn, Jr., and Heath Steele of New York, are new directors.

Yuma County

MAMMON GOLD AND COPPER CO. (Parker)—Contracted with Southern California Drilling Co., of Los Angeles, to sink several holes to locate three-compartment shaft site. One churn drill now working and a diamond drill is shortly to be put to work. Property embraces 32 claims in Cienega district, 10 miles east of Parker. One shaft and three adits now being worked, and ore being shipped. Pittsburgh and New York men interested. William M. Boyce, superintendent.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Joseph J. Rice, chief electrician, was electrocuted May 6 while installing transformers, by contact with 440-volt line running to hoist.

KENNEDY (Jackson)—Shaft has reached 4012-ft. point. New station at the 3900 level is opened and crosscut started. Installation of new boilers completed. Mine employs 390 men; 315 working underground.

KEYSTONE AND ORIGINAL AMADOR (Amador)—These two mines adjoining, and using the same tailing dam, are having trouble with farmers on Amador Creek who complain that land is being damaged on account of a leak in the dam.

Butte County

TRIUMPH GOLD MINING AND MILLING (Lumpkin)—Company recently reincorporated; compressor and drills purchased. Plans to drive lower working tunnel at depth of 600 ft. below old workings. M. B. Sears, president; F. A. Thompson, vice-president; B. G. Sears, secretary-treasurer.

LADY ANN MINING AND MILLING (Lumpkin)—Operating the "1915 Mine" north of the Triumph. Purchased recently by M. Fink and associates of San Francisco. Larger mill planned; 8 men employed at present.

Eldorado County

CHROME mining near Shingle Springs in progress by D. E. Wiley and J. W. Koeftler of Folsom. Ore will be hauled 8 miles to Shingle Springs for shipment by Southern Pacific to Eastern market.

BIG DIKE (Camino)—This big low-grade deposit, consisting of quartz stringers in shale, is being examined with view to exploration by Col. H. G. Torrence of Oakland, Calif.

UNION CHROME (Placerville)—Company has several hundred tons of ore ready at Alabama Flat to haul to Placerville for rail shipment. Chrome ore also mined by this company at Josephine. D. L. Shepherd is superintendent at Alabama Flat mine, and Lester Heindel at Josephine.

Inyo County

CERRO GORDO (Keeler)—Powder thieves reported arrested and two of them said to have admitted theft.

TUNGSTEN MINES CO. (Bishop)—Reconstruction of burned portion of mill progressing. One large ore bin rebuilt. Materials required were received within 16 hours from time of fire Apr. 27, being ordered by wire. Expected to resume operation of mill by May 5.

Kern County

TROPICO (Rosamond)—Mine and mill recently equipped with electric power. Good ore being extracted from 500-ft. depth.

YELLOW ASTER (Randsburg)—Labor agitators, said to be chiefly of foreign birth, induced about 60 men to strike for $4 a day on May 1. Others, mostly Spanish or Mexican, added to the number on Wednesday and tried to intimidate men who continued work. About 40 of the strikers were arrested and sent over to Bakersfield, the county seat to be held for trial, having been arraigned before Justice of the Peace Maginnis in Randsburg and held in default of $200 bail each. Better element of miners in Yellow Aster employ are said to be satisfied.

Mariposa County

HORNITOS DISTRICT is attracting attention by the promised reopening of eight old mines within the summer. The Silver Lead, worked in a small way years ago will probably be reopened by John C. Davis and William McGinn of Jamestown—it is situated 5 mi. from Hornitos. The Ruth Pierce, operated by James McMahon, is reported to be paying dividends. The Duncan mine is extracting and milling ore. The Mount Gaines has just been unwatered, preparatory to extensive development. No. 1 mine owned by William and Edward McGinn and associates is being prepared for resumption. The Quartz Mountain is being developed and site graded for new mill. No. 9 mine will be equipped with new crushing plant; other surface equipment having already been installed.

Nevada County

GOLDEN CENTER (Grass Valley)—Oreshoot disclosed in No. 11 drift 20 ft. south of shaft. The 20-stamp mill working on good-grade of ore.

ALLISON RANCH (Grass Valley)—Draining of No. 2 level completed; level is at 332-ft. point; ore being extracted while unwatering proceeds in levels below.

HIPPERT (Graniteville)—Harry Gessner of Roseville reported to have optioned this mine for five years. Developed by shaft. Samuel Colt, former operator.

Shasta County

COW CREEK CHROME (Casell)—Eight miles of road on Castle and Cow Creeks, about 20 miles west of Casell, being built preparatory to shipping chrome ore. Said to be about 6000 tons blocked out. Company composed of San Francisco men.

COLORADO

Boulder County

HURON (Boulder)—Sold recently to Denver men, who will commence work at once.

MOGUL (Boulder)—Old workings being cleaned out preparatory to regular operation.

SNOWBOUND (Boulder)—Development work being done by Denver purchasers.

KOHLMAN (Eldora)—Satisfactory progress being made in driving this crosscut tunnel. Mill will be built near portal on Middle Boulder Creek.

REVENGE (Eldora)—Gold ore developed reported to warrant building mill this year. Development work on Barbee claim, an extension of the Revenge progressing with satisfactory results.

Clear Creek County

SILVER PLUME is experiencing a revival such as has not been seen here for years. Old La Veta Hotel, vacant for a generation, has been refurnished and reopened; two new boarding houses for miners also built.

AETNA (Georgetown)—Being worked by Bruce & Co., lessees. Regular shipments smelting-grade ore made.

Gunnison County

ALASKA-YUKON PROPERTY, in Cochetopa district, taken over by Delta men. First work will be sinking another 100 ft. on Yukon claim.

Lake County

CARBONATE (Leadville)—Recent strike increasing in size as development work proceeds. Regular production will be made as soon as railroad siding is finished.

Ouray County

LONERGAN GROUP (Ouray)—Bonded by Ouray men and work will begin as soon as weather conditions permit. Property is an old copper-silver producer in same belt as Guston, Yankee Girl, Genesee-Vanderbilt and other famous mines.

DEVIL'S GATE-SPION KOP (Ouray)—This group, owned by Otto Samuelson, reported sold to Smuggler-Union Mining Co., of Telluride, for $60,000. Group consists of six claims adjoining Humboldt ground of that company, on Ouray-San Miguel county line.

Pitkin County

KEYSTONE (Aspen)—Reported 8-ft. shoot good-grade lead-silver ore recently opened.

San Juan County

KITTIMAC (Silverton)—New orebody opened in development work. Flotation has to a large extent solved tailing-loss problem.

HAMLET (Howardsville)—Mine and mill overhauled; flotation installed in mill. Large body of milling-grade ore developed.

San Miguel County

SILVER BELL (Ophir)—Main tunnel now in 3000 ft. Good-grade ore opened in old workings.

BADGER TUNNEL (Ophir)—Colorado Springs company has taken lease and bond on group formerly belonging to Suffolk Gold Mining Co., and will operate through Badger Tunnel this summer.

TOMBOY (Telluride)—In April mill ran 27 days, crushing 11,500 tons, yielding $39,500 in bullion, and $58,000 in concentrates; operating expenses, $68,500; profit, $29,000; other income, $1000.

Teller County

VINDICATOR (Cripple Creek)—Hull City shaft leased and work will start at once.

ACACIA (Cripple Creek)—Lessees on 11th level of South Burns shaft opened body of $56 ore.

UNITED GOLD MINES CO. (Cripple Creek)—Shaft on Wild Horse claim will be sunk an additional 300 ft.

REQUA SAVAGE (Victor)—Lessees working dump at main shaft on Beacon Hill; carload of payable ore shipped.

LONGFELLOW (Victor)—The 230-ft. shaft is being enlarged to two compartments under contract, by Fred Sutherland, of Victor. When present improvements are completed, shaft will be sunk an additional 500 ft.

ELKTON (Elkton)—Considerable work being done by lessees. Much milling-grade ore shipped to Golden Cycle mill from main shaft workings and from dump; lessees in Thompson shaft making regular shipments, and some ore being shipped from Raven dumps. Tornado shaft workings also being reopened by lessees.

IDAHO

Shoshone County

MARSH (Burke)—Marsh company will use mill only one-third of month instead of half, as formerly announced, and Hecla two-thirds.

BUNKER HILL & SULLIVAN (Kellogg)—Electric current now available for new smeltery, Washington Water Power Co. having completed its substation; will be able to furnish about 4000 hp. to the smeltery.

JACK WAITE (Wallace)—Ore shipments resumed after delay of several weeks on account of snowslides on wagon road. Ore hauled 10 miles to railroad at Waite station. Seven feet of shipping ore in one stope, and much lower-grade ore available. Shipping 300 tons per month, averaging 50% lead; silver content low.

MAINE

Hancock County

DOUGLAS (Blue Hill)—This old copper mine, reopened by the American Smelting and Refining Co. Shipments will be made to Perth Amboy, N. J., and low-grade ore concentrated in flotation plant. E. E. Price, superintendent.

MICHIGAN

Copper

NEW BALTIC (Baltic)—Shaft ready for hoisting in about a month.

CALUMET & HECLA (Calumet)—Building new coal dock to have capacity of about 800,000 tons.

CHEROKEE (Houghton)—Drift on second level in 25 ft.; shaft down 325 ft. East drift on third level just begun.

VICTORIA (Victoria)—Tonnage for April about 100 tons. Work on mill extension not yet completed. Retimbering old skipway.

ADVENTURE (Greenland)—Short of men. Working on the Butler, Knowlton, and Evergreen lodes, all three of which are profitable.

MICHIGAN (Rockland)—Opening all three lodes for production; five drills in operation; first skip now in commission and the second will be ready soon.

HANCOCK (Hancock)—Operating two storage-battery locomotives, one at the 53rd level and one at the 49th level; increase in tonnage expected this month.

OSCEOLA (Osceola)—Owing to shortage of men, hoisting only about 4000 tons daily, as compared with an average of over 4500 tons during winter months. Drift going to the LaSalle is now 1200 ft. in LaSalle territory.

MAYFLOWER-OLD COLONY (Calumet)—Company has bought second-hand hoist with capacity for 3000 ft., and will soon commence sinking three-compartment shaft about 300 ft. south of the dividing line between the two properties.

FRANKLIN (Hancock)—Fourth mechanical-haulage system (32nd level) now in operation; this being the only electrical installation of the four, it is being watched with considerable interest. Expected to be an improvement over the compressed-air installations.

NEW ARCADIAN (Houghton)—New 18-drill compressor shipped; expected to be in operation within one month, when sinking will be begun and considerable more drifting and stoping carried on. Raise started in northern drift at 1500-ft. level. Eight cars a day shipped to the Franklin mill from stockpile.

MINNESOTA

Cuyuna Range

RALEIGH (Barrows)—Concrete drop-shaft has been "ledged."

PENNINGTON (Ironton)—Two shovels loading from pit. Has contract to ship 200,000 tons.

CROFT (Crosby)—A 14-in. casing extending from surface to underground workings will be used as timber chute.

CUYUNA-MILLE LACS (Ironton)—Has abandoned 205-ft. level and is hoisting from 125-ft. level. Sinking at No. 2 shaft progressing rapidly. Shipping from 50,000-ton stockpile of manganiferous ore to Dunbar, Penn.

MISSOURI

Joplin District

WALKER (Miami, Okla.)—Opened big cave, lined with galena, at depth of 200 ft. on lease northwest of Picher, Okla.

McBRIDE (Joplin)—Opening two new shafts at property in Leadville Hollow. Mill being operated steadily.

KING DAVID (Joplin)—Has completed 150-ton mill on Connor land, north of Chitwood. Ore opened from 85 to 125 ft.

LUCKY HUNCH (Joplin)—Building 300-ton mill on Dawes farm, southwest Baxter, Kan. Seventeen drill holes show ore from 120 to 160 ft. J. G. Marcum, Joplin, interested.

U. S. PAYMASTER (Joplin)—New mill on Lewellyn land north of Bell Center in operation. Shaft being sunk to 125 ft. Dr. M. C. Weaver, Batesville, Ark., president and manager.

STATE LINE (Afton, Okla.)—Encountered good ore on lease south of Baxter, Kan. Ore at two levels; a face 20 ft. thick indicated at depth of 192 ft. Will build mill.

ABRAM & GRIMES (Baxter, Kan.)—Have sold lease at Sunnyside, Okla., to Tulsa men for $25,000 cash. Same property was sold last summer to I. & O. Mining Co., but reverted to owners.

WACO (Joplin)—Has started moving McGreggor mill from south of Carterville to newly developed tract in new Waco field. Mill was built only a year ago. Two shafts nearing completion. P. B. Butler, manager.

GIBSON (Joplin)—Now milling 900 tons of ore; mill operating three shifts. Has big semi-circular ore face in mine, 20 ft. in height; nine drill men in one shift break down ore for a day's mill run.

MONTANA

Lewis and Clark County

SCRATCH GRAVEL GOLD (Helena)—New strike of rich gold-silver-lead ore above 500-ft. level. Walter Larssen, superintendent; Thomas B. Miller, general manager.

HELENA (Helena)—Shaft nearing 300-ft. level. Several cars lead ore containing gold, silver and iron shipped to smeltery. Equipment includes 50-hp. steam plant, air compressor and Jackhamer drills. Mine in Grass Valley section, operated by the Helena Mining Bureau, S. A. Balliett, president.

NEW- YORK-MONTANA ORE TESTING AND ENGINEERING (Rimini)—This plant has made its first shipment to East Helena smeltery of 50 tons of concentrates. Treating ore from 25,000-ton Valley Forge dump. Ratio of concentration 6:1. Concentrates contain about $45 per ton in gold and silver.

Silver Bow County

GREAT BUTTE MINING (Butte)—Has finished sinking Calumet shaft to 1500-ft. level; installing station and pumps preparatory to crosscutting.

ANACONDA (Butte)—Following the opening of 8-ft. orebody on 1600 level of the Emma, it is announced that crosscut on 1000-ft. level has disclosed 15 ft. of mixed ore of which about 5 ft. is of shipping grade.

MINES OPERATING (Butte)—New leaching tanks at the Butte-Duluth plant installed; will enable output to be doubled. In April produced 100,000 lb. of copper, treating about 200 tons per day. May production expected to exceed 150,000 lb.

NORTH BUTTE (Butte)—April production was 1,911,763 lb. copper; 94,769 oz. silver; 123 oz. gold. Copper production off about 600,000 lb. from March due to closing of mines on account of High Ore fire. Speculator shaft being retimbered.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—New stope started from east drift 300-ft. level.

LONE STAR (Goldfield)—At annual meeting, Apr. 17, Nathaniel H. Wheeler was elected president. Stated Mr. Wheeler has acquired the Waterson interest and plans extensive development.

DIAMONDFIELD BLACK BUTTE (Goldfield)—Campbell lease continues to produce small tonnage of excellent ore from vicinity of old Quartz stope. Company operating 6-in. core drill for exploration at depth.

Humboldt County

ANTELOPE DISTRICT is doing considerable development. Three and one-half miles south of this station on the Western Pacific R.R., J. F. Dwyer (Antelope via Sulphur) is developing a silver vein varying in width from 3 to 30 ft.; adjoining quartzite carries some gold. About four miles farther south, Lee Curry (Jungo postoffice) has lately made a promising gold strike. Craven Copper Co., 16 miles northwest of Antelope station, is employing 11 men and has shipped three cars of 15% ore. California men have bonded the Wells copper claims, south and west of the Craven property.

Mineral County

NEVADA NEW MINES CO. (Rawhide)—Active development campaign in progress and shaft will be sunk to 1000 ft. this year. In Victor shaft, last fall, good ore was opened on 600 level and winze was sunk to 750 ft.; from winze, drifts were run north and south, every 50 ft., and a body of good milling ore developed. E. W. King has severed connection with company, which is controlled by M. Scheeline and associates. Mill not started owing to shortage and high price of cyanide. Alexander M. Boyle now general superintendent.

Nye County

TONOPAH ORE PRODUCTION for week ended May 5 was 9604 tons valued at $177,674 compared with 9646 tons for week previous. Producers were: Tonopah Belmont, 2999 tons; Tonopah Extension, 2380; Tonopah Mining, 2300; Jim Butler, 800; West End, 786; Rescue-Eula, 193; McNamara, 127; Halifax, 121; North Star, 53; Cash Boy, 50; Montana leases, 95 tons.

MANHATTAN CONSOLIDATED (Manhattan)—Shaft down 320 ft.; cutting station at 312-ft. point; will crosscut to vein before sinking to fourth level.

WHITE CAPS EXTENSION MINES CO. (Manhattan)—Plans to sink three-compartment shaft to 400 ft. as soon as equipment can be assembled.

WHITE CAPS (Manhattan)—Have set auxiliary hoist on 435-ft. level and will resume shaft sinking while development continues on upper levels. Erecting Wedge roaster at mill and expect to be treating ore by June 1.

WAGE SCALE AT MANHATTAN, adopted at meeting of mine operators, will become effective May 10: Machinemen, $5 per shift; in shaft work, $5 per shift for hand work and $5.50 for machine work; timbermen, $5; muckers, $4.50; cagers, $4.50; pumpmen, $5; timber framers, $5.50. For surface employees: Engineers, $5 per shift, with understanding that if engineers also help frame timbers, or sharpen steel, that they be paid an additional 50c. per shift; an additional 50c. to be paid should engineers be employed in operation of double-drum hoists. General blacksmith to be paid $5.50; tool sharpeners, $5; blacksmith helpers, $4.50; machinists, $5.50; machinist helpers, $4.50; carpenters, $6; timber framers, $5.50; ore sorters, $4; top men, $4; laborers, $4; electricians, $5; pipe men and track men, $5. Scale for mill employees to be announced later.

Storey County

ANDES (Virginia)—Saved 108 cars from 350 level sampling $7.54 per ton. East crosscut started into hanging wall of vein.

CON. VIRGINIA (Virginia)—Southwest drift on 2700 level advanced 2 sets wide 10 ft. Saved 121 cars averaging $15.60 per ton; also 54 cars averaging $13 from raise at 136-ft. point in drift. During April company shipped 514 tons to Mexican mill.

MEXICAN (Virginia)—Repairing southeast drift from 2700-2900 winze. Sank on ore in 2700 level to depth of 10 ft. and extracted 13 tons averaging $20.23. Work continued on 2000 and 2300 levels in quartz of low assay. Mill operated 88% of time and crushed ore from Mexican, Union, Sierra Nevada, Con. Virginia. Five bars bullion shipped to Selby.

SOUTH CAROLINA

Abbeville County

SULLIVAN MINING CO. (McCormick)—This company, controlled by Lebanon, Tenn., men, is operating the old Dorn mine and has been milling $10 ore in its 10-stamp mill. Concentrating equipment is to be added. Two other companies preparing to begin development work in same vicinity.

SOUTH DAKOTA

Lawrence County

HOMESTAKE (Lead)—Car of tungsten concentrates recently shipped to Eastern market. Tungsten mill is in continuous operation, treating about 25 tons of ore daily.

WASP NO. 2 (Flatiron)—At annual meeting, dividend of 3% was ordered paid. Property suspended in November for the winter and it has been decided not to resume operations until labor conditions become more settled.

UTAH

Beaver County

CREOLE MINES (Milford)—Purchased five patented claims, belonging to old Creole Mining Co. Cash payment made. New company incorporated for $250,000, par value of each share 25c. Property opened to 350 ft. Ore to be hauled 7 miles to Milford by motor truck. During last 18 months produced 104 cars of copper ore. Will ship one car per day, and later, with new equipment, will increase output. H. S. Woolley and associates, of Salt Lake City, interested.

Box Elder County

LAKEVIEW MINING (Saline)—This property, 25 miles west of Ogden—until recently controlled by Utah men, W. A. Perkins and S. S. Arentz and associates—reported taken over by New York men, who will undertake extensive development. Company began payment of dividends in 1915, not quite a year after location, and has paid $124,000, chiefly from zinc ore. Lessees at present operating property, shipping from six to eight cars of ore monthly, partly zinc and partly lead. Mine opened to 300 level.

Juab County

TINTIC SHIPMENTS for week ended May 4 amounted to 188 cars.

RIDGE & VALLEY (Eureka)—Body of mineralized quartz opened on 1500-ft. level.

EUREKA MINES (Eureka)—Recent find on 1300 level said to justify stoping.

EUREKA STANDARD (Eureka)—Eleven claims and mill site recently added to company holdings.

CHIEF CONSOLIDATED (Eureka)—Report for first quarter shows ore sales amounting to $451,611 from 19,566 tons of ore; development amounting to 5031 ft. done, part at Plutus and part at Piñon Peak. Work of enlarging shaft being carried on from 1000- to 1800-ft. level. Dividend of $44,201 paid.

Salt Lake City

MICHIGAN-UTAH (Alta)—Accumulation of 1200 tons at Tanner's Flat being brought to market by teams. Since May 1, between 300 and 400 tons shipped.

MONTANA-BINGHAM (Bingham)—Two shifts driving main tunnel; now in 4785 ft. Face at present in Bingham-Amalgamated ground. Country is quartzite. The 1300-ft. Congor raise, being driven a few hundred feet from face, will soon connect with old Congor workings.

FORTUNA (Bingham)—Property, on which Eccles interests of Ogden formerly had bond, now being worked by J. E. Higgins and associates, of Butte. Mill tests were made recently on some of the fractured quartzite, which carries copper and iron in the footwall of the veins. A 100-ton plant is spoken of to mill this material. Iron- and copper-sulphide ore is being shipped. April output 400 tons; 45 men employed.

Summit County

KEYSTONE (Park City)—Drifting from Daly-Judge tunnel into this ground; in 100 ft.; total distance to Keystone, 1200 ft.

ONTARIO (Park City)—Ore being mined on 1700 level, which was flooded after accident to shaft; now free of water.

JUDGE MINING & SMELTING (Park City)—New oreshoot being developed in southwestern part of property on 900-ft. level, followed for 260 ft.; from 3 to 7 ft. in thickness.

THREE KINGS (Park City)—Compressor arrived and being installed. Development will soon be resumed and sinking of winze—down 180 ft. below 500—to limestone-quartzite contact to be continued; expected in 50 ft.

Utah County

BAY STATE MINING AND DEVELOPMENT (American Fork)—Statement issued by directors shows main tunnel in over 300 ft. and total workings of 1065 ft. Some high-grade ore on dump, and 1000 tons carrying 5 to 8% lead and 8 to 10 oz. silver. Assessment ½c. share levied.

CANADA

British Columbia

GRANBY CONSOLIDATED (Anyox)—Some of the more silicious sulphide ores—not heretofore included in ore reserves—are to be tested in a 100-ton experimental flotation plant.

Ontario

VIPOND (Porcupine)—Drifting on 600-ft. level on 22-ft. vein of fair ore.

TRETHEWEY (Cobalt)—In opening an old stope, found vein of high-grade ore.

KERR LAKE (Cobalt)—Established new production record in April with 250,683 oz. of silver.

CANADIAN KIRKLAND (Kirkland Lake)—Test pits have disclosed five promising veins.

KIRKLAND LAKE (Kirkland Lake)—Has cut vein on 600-ft. level where it shows width of 27 ft.

LAKE SHORE (Kirkland Lake)—Cut new vein under the Lake in long crosscut from main shaft.

SCHUMACHER (Schumacher)—Mill to be doubled to 250 tons capacity. Work will be started about end of May.

WEST DOME (Porcupine)—Vein, encountered in diamond drilling, crosscut on third level where it is 8 ft. in width and averages $7.

DOME (South Porcupine)—April production, $132,000, from 28,900 tons; average value, $4.60 per ton. Liquidation in this stock continued with lower prices ruling.

PETERSON LAKE (Cobalt)—Annual report shows net operating loss of $43,555 with cash assets on hand, $53,491, less $4572 unpaid dividends.

THOMPSON KRIST (Porcupine)—Diamond drilling is being continued but, contrary to reports, no discoveries of importance have been made.

McKINLEY-DARRAGH (Cobalt)—Stamps superseded by ball mill, which is expected to crush about 175 tons daily. Stamps will not be dismantled.

MILLER LAKE O'BRIEN (Gowganda)—Silver vein, 12 to 30 in. wide, encountered below the 300-ft. level, is stated to be as rich as any found in mine.

REEVES-DOBIE (Gowganda)—This mine is again being operated. A cobalt vein on which there are some old workings being opened and high-grade ore taken out.

McINTYRE (Schumacher)—Diamond drilling below 100-ft. level has shown that vein extends to at least 1650 ft. Oreshoot proved for 1000 ft. in length and company is considering doubling mill capacity, now 600 tons a day.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—In March milled 19,549 tons; profit about $38,200.

ALVARADO (Parral Chih.)—Shipped 12 carloads concentrates through El Paso recently; first to cross line in several months.

MEXICAN MINES OF EL ORO (El Oro, Mex.)—Crushed 9200 tons in March; realization $196,000; working expenses $60,000; development $8000; export tax $12,000; profit $116,000.

CHILE

CHILE EXPLORATION (Chuquicamata)—April copper output 8,028,000 lb., comparing with 8,714,000 in March.

RUSSIA

IRTYSH CORPORATION (Ekibastous, Siberia)—Produced in March 42 long tons of spelter; shipped in fulfilment of government orders 192 tons; second block of zinc retorts started. Kirgiz company produced 8638 tons of coal; 642 tons of coke. Ridder company produced from Sokolni mine 1629 tons; milled 447 tons, yielding 17.4 tons of zinc concentrates and 46 tons of lead concentrates; milling restricted by abnormally cold weather; Ridder railway completed.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver New York, Cents	Silver London, Pence	May	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
10	4.7550	74⅜	37⅞	14	4.7545	74⅞	38
11	4.7550	74⅜	37⅞	15	4.7550	74⅞	38
12	4.7550	74⅜	38	16	4.7550	74⅞	38

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	28½		9½	9½	9.10
10	@29	64	@10¼	@10¼	@9.20
	28½		10	10	9.05
11	@29½	64½	@10½	@10½	@9.15
	28½		10	10	9.05
12	@29¼	64½	@10½	@10½	@9.15
	28½		10	10	9.05
14	@29	65	@10½	@10½	@9.15
	28½		10	10	9.05
15	@29	65¼	@10½	@10½	@9.10
	28½		10	10	9.10
16	@29	66¼	@10½	@10½	@9.20

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

May	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
10	130	129½	142	240½	240¾	30½	54
11	130	129½	142	243	243¼	30½	54
12							
14	130	129½	142	246¾	246¾	30½	54
15	130	129½	142	253	253	30½	54
16	130	129½	142	256½	256¼	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅞c.

NEW YORK—MAY 16, 1917

The markets were not very interesting last week, the volume of business being less in nearly all cases, and there being but little change in prices. However, there was fair activity all around and in tin there was again a sharp advance.

Copper, Tin, Lead and Zinc

Copper—The buying by domestic consumers continued, but was considerably less in the aggregate than during the previous week. However, there was a fair business done every day, and coming from so many miscellaneous quarters, it reflected a healthy situation. A noteworthy feature was the sale of a round lot for export, something that has not figured in our reports for a long time heretofore. Among domestic buyers the chief business was with wire drawers. Detroit bought some copper. The buying by brass makers was relatively trifling.

The bulk of business during the week was for third-quarter delivery, which is the major market at this time, and was done at 28¾c. (29c., r.t.) to 29c. However, there was a good deal of irregularity in prices, according to delivery. Business in June copper was done at 32c., r.t., but probably could have been bought at less by shopping. July copper is getting scarce and was quoted at 30c. Deliveries extending into the fourth quarter were offered at sharp concessions in prices.

Copper Sheets—The price of copper sheets remains the same as shown by our quotation last week. We quote hot rolled at 40@42c. per lb. cold rolled 1c. higher. Wire is now quoted 36@38c., f.o.b. mill.

Tin—In the early part of the week the volume of business fell off, but in the latter part there was an increasing demand at advancing prices, and transactions again attained considerable proportions. The situation in this market is extremely disagreeable. June permits for shipments from the Straits were cut down materially and there is now a prospect of higher freight rates in July.

Lead—The easier tendency that was discernible at the close of last week was of but slight duration and within a day or two the market became tighter than ever. There was an active demand for lead which was exhibited in the purchase of many small lots—50 and 100 tons—transactions in round lots—200 tons and over—being relatively few. The aggregate of all transactions reported was somewhat larger than in the previous week. The bulk of the business was done at 10@10½c., according to delivery, whether May, June or July. May lead is very scarce indeed and most sales were of June lead. Spot lead at New York realized as high as 11½c. for carloads.

Zinc—Transactions were light. There was a slightly firmer tendency, but generally speaking, the market was rather dead. Time of delivery no longer cuts any figure in the price. Brass special was sold at 9⅝c., which is a premium of only about ½c. per lb. over Prime Western.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market continues quiet and devoid of any features of special interest. Quotations continue at about the same level, 59@61c. per lb. for No. 1 ingots at New York.

Antimony—Price advanced gradually to 26c. where it now remains with market conditions slightly easier. Market for May-June shipment from China very strong at 16¼@17c., c.i.f., New York, duty unpaid.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Quicksilver—Market rather weak at $105 to 108, owing to good arrivals. San Francisco reports by telegraph, $110, firm.

Gold, Silver and Platinum

Gold—According to a report from Samuel Montagu & Co., London, under date of Apr. 26, the Bank of England gold reserve against its note issue showed an increase of £137,765 over the previous week. It is announced that when the sales now being made in India on account of the Indian Currency Reserve are completed, and the parity between the rupee and sovereign of 15 to 1 again becomes normal, a portion of the sovereigns held in India in the currency reserve will be released. Gold bars to the value of $13,600,000 have arrived from Canada for account of J. P. Morgan & Co., and have been deposited in the Federal Reserve bank. Gold coin to the amount of $750,000 has been withdrawn from the New York subtreasury for shipment to Spain.

Silver—The metal has remained very steady at 38 pence in London for the past four days. The chief demand has been for India, but owing to the high war rates across the Atlantic and the low rates across the Pacific shipments from New York have diminished materially, while those from San Francisco have increased very largely; silver being shipped from San Francisco to China ports, and being distributed from there to India or elsewhere as commercial demands require.

Samuel Montagu & Co., London, report under date of Apr. 26, that business has been steady. Shanghai exchange has risen in sympathy with the price of silver.

Mexican dollars at New York, May 10, 57¾c.; 11, 57⅝c.; 12, 57⅝c.; 14, 58c.; 15, 58c.; 16, 58c.

Platinum—The demand was fair and steady. Sales were made at $105, which we quote as the market.

Our Petrograd correspondent reports under date of Mar. 26, that the revolutionary movement is not expected to influence the position of platinum, at least in the near future. From Ekaterinburg it is reported that the cost of production among the small producers is increasing and that the government-fixed price of $80.36 per oz. does not satisfy them.

Palladium—The strong demand continued. This market became even firmer than in the case of platinum. Sales were made at $105, which we quote as the market.

Zinc and Lead Ore Markets

Platteville, Wis., May 12—Blende, basis 60% Zn, $75 for premium ore down to $68 for medium grade, the market being somewhat stronger at the week end. Lead ore, basis 80% Pb, $115 to $126 per ton. Shipments reported for the week are 2532 tons of zinc ore, 263 tons of lead ore, and 736 tons of sulphur ore. For the year to date the figures are: 48.961 tons of zinc ore, 1978 tons of lead ore and 9805 tons of sulphur ore. Shipped during week to separating plants, 3579 tons of zinc ore.

Joplin, Mo., May 12—Blende per ton, high $81.60; basis 60% Zn, premium ore $80, medium to low, $75@70; calamine per ton, basis 40% Zn, $40; average selling price, all grades of zinc, $72.68 per ton.

Lead, high $120.35; basis 80% Pb, $120@115; average selling price, all grades of lead, $117.34 per ton.

Shipments the week: blende, 9626 tons; calamine, 744 tons; lead, 1318 tons. Value all ores the week, $908,600. Increase over last year; blende, 23,438; calamine, 3100; lead, 5635 tons.

A revision of estimates returned to the Southwest Safety and Sanitation Association by the mine operators comprising its membership makes a radical change from the previous estimate. The revision indicates there are but 15% of the mines in the sheet-ground area that can produce ore profitably on a $70 basis, 40% on a $75 basis and 45% require approximately an $80 base. The higher price range this week permits some margin of profit to nearly all the sheet-ground mines.

Other Ores

Antimony Ore—Business done in ore for shipment from South America at $2.30 per unit, per short ton.

Manganese Ore—Demand active. Principal buyer maintains its schedule price at $1 per unit for 49% ore. Lower grades of ore have found ready buyers. Chemical ore is quoted at 4½@6c. per lb.

Molybdenum Ore—Scarcely any business reported. Prices unchanged.

Pyrites—Furnace-size Spanish pyrites quoted at 15c. per unit on basis of 10s. ocean freight, buyer to pay war risk and excess freight; late cargoes have paid 35@37s. Domestic pyrites is mainly contracted at 10@10½c. per unit, but new production has been sold at widely varying prices between 10@16c. and even higher.

Tungsten Ore—Continuance of the strong demand for prompt delivery forced buyers to pay the price asked by producers; that is, $20 per unit, basis 60%, which we quote as the market for the week.

Ferroalloys

Ferromanganese—The spot market is not clearly defined, on account of light supplies and light enquiry, being probably $425@450 for carloads. Second half is about $400 and last quarter about $375, all for domestic, imported not being a factor.

Ferrochromium—Standard quoted at 33c. per lb. for distant positions.[1]

Ferromolybdenum—Content, 50 to 60%, $4.25 per lb. of metal contained.[1]

Ferrouranium—Quoted at $7.50 per lb.[1]

Ferrovanadium—Producers sold up and declining to quote.[1]

[1]Quotations supplied by Foote Mineral Co., Philadelphia.

Iron Trade Review

NEW YORK—May 16

The Government's needs in steel are still indefinite and producers are patiently awaiting the development of its plans, says "Iron Age." Meanwhile the uncertainty hampers consumers as well as the mills, and there is a growing belief that domestic users of plates will find more rather than less difficulty in supplying their wants.

The estimate of some authorities that eventually the ship plate capacity of the country will be almost entirely taken up by the Government is surprising in view of an output last year of probably 1,750,000 tons of sheared plates over ¼ in. in thickness, besides more than 1,500,000 tons of universal plates and plates under ¼ in. thick. Even if 2,000,000 tons of steel vessels could be built in 1918 that would represent less than 1,000,000 tons of plates and structural shapes, and the latter would be more than 20%.

The wire rope required by the Government and its Allies, chiefly France, at first put at 9000 tons, is now estimated at 24,000 tons for this year. Manufacturers have arranged for its distribution, and wire manufacturers are to meet on Friday to apportion the requisite wire.

The Government is making a survey of the ferromanganese situation through a committee representing importers as well as domestic manufacturers. Steel companies are to report stocks on hand, requirements in the remainder of the year, and expected receipts under existing contracts. It is fortunate that domestic production is increasing, though slightly, as indications are that Great Britain will not be able to furnish as much ferromanganese this year as in 1916.

PITTSBURGH—May 15

The Government steel requirements are likely to cause important postponements in the filling of contracts with other steel consumers only in the case of plates and sheets. The sheet requirements are proving larger than was anticipated, and the automobile trade is among those that will probably experience a delay in deliveries. The Shipping Board's requirements for plates for the proposed small steel merchant vessels may possibly involve as much as 40,000 tons a month, less than 15% of the current output of plates, but perhaps 25% of the output of the particular description of plates involved. The requirements in other steel products are unlikely to prove particularly disturbing to general trade.

The Steel Corporation's increase of 471,439 tons in unfilled obligations during April reflects the contracting for sheets and tin plates for the second half of the year, practically confined to the single month. May will probably show a considerable decrease, as the Steel Corporation is almost out of the market in many departments. Even among the independents the turnover in steel products is materially decreased, partly because the mills are already so well sold up and partly because some classes of consumers are now pursuing a more conservative buying policy.

Steel prices continue to advance. It is rarely that 3.50c. can be done on bars, 4c. on shapes and 6.50c. on black sheets, more common prices being 3.75c., 4.50c. and 7c. respectively.

Pig Iron—One of the first orders of the centralized railroad control was in favor of the lake coal and iron-ore movement, whereby other shippers can be cut down to 20% in open-top cars until this movement is fully provided for. This has resulted in decreased car supplies to many blast furnaces and the pig-iron market has felt the influence in decreased activity, both sellers and buyers being in the dark. After heavy transactions in basic iron at the old price of $40, valley, sales of 5000 tons or more have been made at $42, establishing the market at a $2 advance. Foundry grades have advanced $1, to $43, for this year, and $2, to $42, for first half 1918. Bessemer has sold in small lots at $46, and later at $48, and the large-lot figure of $44 may have disappeared. There is enquiry in the market which should settle this point within two or three days.

Steel—After heavy purchases of sheet bars at prices up to and including $85, there have been purchases of 7000 to 10,000 tons at $90, with rumors of $100 or higher being paid on small lots and the whole market is correspondingly higher, $90@95 for billets and $90@100 for sheet bars.

Coke

Connellsville—Car supplies are only fair this week and the market is under considerable tension, with spot at $8 for furnace and $9.50@10.50 for foundry. Second half furnace is about $8 but operators continue indisposed to make definite offers, seeing so many uncertainties.

Foreign Iron

"Iron Age" reports, through a cable from London, that the pig-iron output of the United Kingdom for 1916 was 9,047,983 gross tons, of which 4,042,014 tons was hematite iron, 2,290,549 tons basic iron and 1,418,824 tons foundry iron. The steel output was 9,244,457 tons, including 1,196,153 tons of acid bessemer steel, 505,817 tons of basic bessemer, 4,393,004 tons of acid open hearth and 3,012,558 tons of basic open hearth. (The 1915 pig-iron output was 8,793,659 tons and the steel production, 8,350,944 tons.)

STOCK QUOTATIONS

N. Y. EXCH.†	May 15
Alaska Gold M.	6⅛
Alaska Juneau	5
Am. Sm. & Ref., com.	97⅛
Am. Sm. & Ref., pf.	110⅛
Am. Sm. Sec., pf. A	98⅛
Am. Sm. Sec., pf. B	90⅛
Am. Zinc	29⅛
Am. Zinc, pf.	63
Anaconda	77
Batopilas Min.	1
Bethlehem Steel	130
Bethlehem Steel, pf.	120
Butte & Superior	42⅛
Cerro de Pasco	36⅛
Chile Cop.	21
Chino	53⅛
Colo. Fuel & Iron	48
Crucible Steel	65⅞
Dome Mines	12⅛
Federal M. & S.	11⅛
Federal M. & S., pf.	38
Great Nor., ore ctf.	30⅛
Greene Cananea	41
Gulf States Steel	120
Homestake	113
Inspiration Con.	54⅜
International Nickel	38⅛
Kennecott	44
Lackawanna Steel	86
Miami Copper	38⅛
Nat'l Lead, com.	53⅛
National Lead, pf.	105
Nev. Consol.	23⅛
Ontario Min.	5⅛
Quicksilver	2
Quicksilver, pf.	2
Ray Con.	28⅛
Republic I.&S., com.	80⅛
Republic I. & S. pf.	101⅛
Sloss-Sheffield	50
Tennessee C. & C.	15⅜
U. S. Steel, com.	116⅛
U. S. Steel, pf.	117
Utah Copper	112⅛
Va. Iron C. & C.	65

N. Y. CURB†	May 15
Big Ledge	2⅛
Butte & N. Y.	1⅞
Butte C. & Z.	10⅛
Caledonia	.57
Calumet & Jerome	1⅛
Can. Cop. Corpn.	1⅛
Carlisle	5
Con. Ariz. Sm.	1⅛
Con. Coppermines	4⅛
Con. Nev.-Utah	⅛
Emma Con.	⅛
First Nat. Cop.	2⅛
Goldfield Con.	.51
Goldfield Merger	.05
Greenmonster	1⅛
Hecla Min.	7⅛
Howe Sound	5.56
Jerome Verde	1⅛
Joplin Ore & Spel.	.17
Kerr Lake	4⅛
Magma	43
Majestic	.46
Mckinley-Dar-Sa.	.51
Mohican	⅛
Mother Lode	.26
N. Y. & Hond.	14
Nipissing Mines	7⅛
Ohio Cop.	⅛
Ray Hercules	3⅛
Rochester Mines	.67
St. Joseph Lead	17⅛
Seneca	‡11
Standard S. L.	.75
Stewart	.25
Success	.35
Tonopah	5⅛
Tonopah Ex.	2⅞
Tribullion	.25
Troy Arizona	.28
United Verde Ext.	38
United Zinc	4⅛
White Knob, pf.	1⅛
White Oaks	‡2
Yukon Gold	1⅛

SAN FRAN.*	May 15
Alta	.03
Andes	.17
Best & Belcher	.06
Bullion	.02
Caledonia	.18
Challenge Con.	.05
Confidence	.10
Con. Virginia	.65
Gould & Curry	.02
Hale & Norcross	.05
Jacket-Cr. Pt.	.05
Mexican	.30
Occidental	.65
Ophir	.14
Overman	‡.03
Savage	.04
Sec. Belcher	.02
Sierra Nevada	.17
Union Con.	.38
Utah Con.	.02
Belmont	3.90
Jim Butler	.71
MacNamara	.09
Midway	.13
Mont.-Tonopah	.19
North Star	.11
Rescue Eula	.26
West End Con.	.64
Atlanta	.10
Booth	.07
Comb. Frac.	.04
D'field Daisy	.03
Florence	.17
Jumbo Extension	.37
Kewanas	.13
Nevada Packard	.36
Round Mountain	.31
Silver Pick	.10
White Caps	1.45
Ariz. Central	‡.10
Big Jim	.65
Lazy Boy	‡.01
Nellie	.15⅛
Tom Reed	1.93⅛
United Eastern	4.07⅛

BOSTON EXCH.*	May 15
Adventure	2⅛
Ahmeek	96
Algomah	.50
Allouez	61
Ariz. Com., ctfs	12⅛
Arnold	.30
Bonanza	.20
Butte-Balaklava	.85
Calumet & Ariz.	78⅛
Calumet & Hecla	535
Centennial	18
Copper Range	60⅛
Daly West	1⅛
Davis-Daly	4⅛
East Butte	12
Franklin	6⅛
Granby	78
Hancock	13⅛
Hedley	15
Helvetia	.30
Indiana	2⅛
Island Cr'k, com.	64⅛
Isle Royale	25⅛
Keweenaw	2
Lake	11
La Salle	2⅛
Mason Valley	5⅛
Mass	11⅛
Mayflower	1⅛
Michigan	3⅛
Mohawk	84
New Arcadian	3
New Idria	15
North Butte	20⅛
North Lake	2⅛
Ojibway	1⅛
Old Colony	2
Old Dominion	58
Osceola	83
Quincy	84
St. Mary's M. L.	76
Santa Fe	1
Shannon	7⅛
Shattuck-Ariz.	25
So. Lake	3⅛
So. Utah	.18
Superior	8⅛
Superior & Bost.	4⅛
Trinity	3⅛
Tuolumne	1
U. S. Smelting	52⅛
U. S. Smelt'g, pf.	49⅛
Utah Apex	1⅛
Utah Con.	15
Utah Metal	⅜
Victoria	3⅛
Winona	3⅛
Wolverine	41⅛
Wyandot	.90

BOSTON CURB*	May 15
Alaska Mines Corp.	.93
Bingham Mines	10⅛
Boston Ely	.56
Boston & Mont.	.64
Butte & Lon'n Dev.	.23
Calaveras	3⅛
Calumet-Corbin	.01
Chief Con.	2⅛
Cortez	.20
Crown Reserve	.31
Crystal Cop	.85
Eagle & Blue Bell	2⅛
Houghton Copper	.90
Intermountain	1⅛
Iron Cap Cop., pf.	.16
Mexican Metals	.26
Mines of America	1⅛
Mojave Tungsten	.38
Nat. Zinc & Lead	.41
Nevada-Douglas	1⅛
New Baltic	1⅛
New Cornelia	16
Oneco	.50
Pacific Mines	‡.25
Rex Cons.	.27

SALT LAKE*	May 15
Bannack	1.15
Big Four	.62
Black Jack	.06
Cardiff	5.50
Colorado Mining	17
Crown Point	‡.05
Daly-Judge	7.50
Empire Copper	1.25
Gold Chain	11
Grand Central	.45
Iron Blossom	.95
Lower Mammoth	.03
May Day	.07
Moscow	12
Prince Con.	1.20
Silver-King Coal'n	2.97½
Silver King Con.	3.82½
Sioux Con.	11⅛
So. Hecla	1.12½
Uncle Sam	.03
Wilbert	.10
Yankee	11⅛

TORONTO*	May 15
Bailey	.03
Beaver Con.	.34
Buffalo Mines	.95
Chambers Feriand	.09
Coniagas	3.10
La Rose	.44
Peterson Lake	.09
Right of Way	.04⅛
T. & Hudson Bay	40.00
Temiskaming	.42
Wettlaufer-Lor.	.05
Dome Exten.	.14
Dome Lake	.17
Foley O'Brien	.60
Hollinger	4.65
Jupiter	.28
McIntyre	1.57
Newray	.75
Porcu. Crown	.58
Schumacher	.47
Vipond	.38½
West Dome	.22

STOCK QUOTATIONS—Continued

COLO. SPRINGS	May 15
Cresson Con.	5.50
Doctor Jack Pot.	.04⅛
Elkton Con.	.06⅛
El Paso	.30
Gold Sovereign	.03⅛
Golden Cycle	2.15⅞
Granite	.50
Isabella	.11⅛
Mary McKinney	.21
Portland	1.48
United Gold M.	.17
Vindicator	.80

LONDON	May 3		
Alaska Mexican	£0	10s	0d
Alaska Tre'dwell	1	15	0
Burma Corp.	4	1	3
Cam & Motor	0	8	6
Camp Bird	0	7	3
El Oro	0	9	0
Esperanza	0	10	9
Mexico Mines	4	0	0
Nechi, pfd.	0	14	0
Oroville	0	15	6
Santa Ger t'dis	0	10	6
Tomboy	0	19	6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	.....	23.570	35.477	.....
June	49.034	65.024	.....	23.267	31.060	.....
July	47.519	62.940	.....	22.597	30.000	.....
August	47.163	66.083	.....	22.780	31.498	.....
September	48.680	68.515	.....	23.591	32.584	.....
October	49.385	67.855	.....	23.925	32.361	.....
November	51.714	71.604	.....	25.094	34.192	.....
December	54.971	75.765	.....	26.373	36.410	.....
Year	49.684	65.661	.....	23.675	31.315	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	.....	135.457	.....	152.522	.....
June	26.601	.....	112.432	.....	137.455	.....
July	23.865	.....	95.119	.....	125.500	.....
Aug.	26.120	.....	110.283	.....	126.304	.....
Sept.	26.855	.....	113.905	.....	134.071	.....
Oct.	27.193	.....	122.750	.....	142.523	.....
Nov.	30.625	.....	134.659	.....	155.432	.....
Dec.	31.890	.....	145.316	.....	162.842	.....
Year	27.202	.....	116.059	.....	138.281	.....

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
March	51.230	55.910	199.736	220.171
May	49.125	.....	196.511	.....
June	42.231	.....	179.466	.....
July	38.510	.....	168.357	.....
August	38.565	.....	169.870	.....
September	38.830	.....	171.345	.....
October	41.241	.....	179.307	.....
November	44.109	.....	186.932	.....
December	42.635	.....	183.368	.....
Av. year	43.480	.....	182.096	.....

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	.....	7.332	.....	32.967	.....
June	6.936	.....	6.749	.....	31.011	.....
July	6.352	.....	6.185	.....	28.137	.....
August	6.244	.....	6.088	.....	29.734	.....
September	6.810	.....	6.699	.....	30.786	.....
October	7.000	.....	6.898	.....	30.716	.....
November	7.042	.....	6.945	.....	30.500	.....
December	7.513	.....	7.405	.....	30.500	.....
Year	6.858	.....	6.777	.....	31.359	.....

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb	18.420	10.045	18.260	9.875	97.762	47.000
Mar	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	.....	14.106	.....	94.217	.....
June	11.752	.....	11.582	.....	68.591	.....
July	8.925	.....	8.755	.....	50.750	.....
Aug.	8.730	.....	8.560	.....	51.587	.....
Sept.	8.990	.....	8.820	.....	52.095	.....
Oct.	9.829	.....	9.659	.....	54.159	.....
Nov.	11.592	.....	11.422	.....	56.023	.....
Dec.	10.665	.....	10.495	.....	55.842	.....
Year	12.804	.....	12.634	.....	72.071	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ‡ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	.....	19.11	.....	19.58	.....
June	21.95	.....	18.95	.....	19.34	.....
July	21.95	.....	18.95	.....	19.20	.....
August	21.95	.....	18.95	.....	19.22	.....
September	22.88	.....	19.58	.....	19.53	.....
October	24.61	.....	21.26	.....	21.51	.....
November	30.07	.....	28.18	.....	26.55	.....
December	35.16	.....	30.95	.....	30.79	.....
Year	$23.88	.....	$20.98	.....	$21.15	.....

‡ As reported by W. P. Snyder & Co.